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Abstract Book

Oral Session -
- Advocate Award Address
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5:00 Advocate Award Address

Oral Session -
100 - Welcome Address and INSAR President Address
8:30 AM - 9:00 AM - Yerba Buena 8-9

8:30 Welcome Address and INSAR President Address

Keynote Address
101 - Biological Origins of Autism Heterogeneity
9:00 AM - 10:00 AM - Yerba Buena 8-9

Speaker: P. Levitt, Institute for the Developing Mind, Children's Hospital Los Angeles, Los Angeles, CA

Typically developing individuals exhibit broad heterogeneity in cognitive, social and emotional behaviors. While neuroscientists are still struggling with understanding the mechanisms that underlie this heterogeneity, the field now has recognized that individual differences, even between two individuals with the same categorical neurodevelopmental diagnosis, can be profound. Thus, the identical causal mutation often leads to clinical symptoms that may differ widely in those who are affected. These differences, in turn, create challenges for implementing the most effective clinical treatments. Studies will be presented that characterize the biological nodes that may contribute to functional heterogeneity. Experiments address the heritable contributions to behavioral heterogeneity broadly, and that different components of complex behavior may be impacted by distinct genetic factors. Moreover, studies will be presented that address circuit, molecular and cellular mechanisms that underlie differences in neurodevelopmental trajectories of vulnerable circuitry. The presentation will emphasize new ideas regarding the biological nodes as being dynamic, and influenced by genetic and environmental factors – all of which can contribute to the thinking about the most effective ways to move away from *'one size fits all'* approaches to treatment.

9:00 Biological Origins of Autism Heterogeneity

***P. Levitt**, Institute for the Developing Mind, Children's Hospital Los Angeles, Los Angeles, CA*

Typically developing individuals exhibit broad heterogeneity in cognitive, social and emotional behaviors. While neuroscientists are still struggling with understanding the mechanisms that underlie this heterogeneity, the field now has recognized that individual differences, even between two individuals with the same categorical neurodevelopmental diagnosis, can be profound. Thus, the identical causal mutation often leads to clinical symptoms that may differ widely in those who are affected. These differences, in turn, create challenges for implementing the most effective clinical treatments. Studies will be presented that characterize the biological nodes that may contribute to functional heterogeneity. Experiments address the heritable contributions to behavioral heterogeneity broadly, and that different components of complex behavior may be impacted by distinct genetic factors. Moreover, studies will be presented that address circuit, molecular and cellular mechanisms that underlie differences in neurodevelopmental trajectories of vulnerable circuitry. The presentation will emphasize new ideas regarding the biological nodes as being dynamic, and influenced by genetic and environmental factors – all of which can contribute to the thinking about the most effective ways to move away from *'one size fits all'* approaches to treatment.

Panel Session
102 - Autism and Intellectual Disability: Patterns of Familial and Environmental Risk
10:30 AM - 12:00 PM - Yerba Buena 3-6

Panel Chair: Brian Lee, *Drexel University, Philadelphia, PA*

Discussant: Avi Reichenberg, *Mount Sinai School of Medicine, New York, NY*

Although autism spectrum disorders (ASD) are clearly heterogeneous, many risk factor studies often consider ASD as a single entity. However, there is increasing evidence that different genetic and environmental risk factors may predispose to different subtypes of ASD. The purpose of this session is to examine the epidemiological, familial, and genetic evidence regarding how patterns of ASD risk may vary by conditions often noted to co-occur with ASD, especially intellectual disability (ID). The first talk will provide an overview of environmental risk factors that have been observed to have divergent associations for ASD with versus without ID. The second talk will discuss how paternal intelligence and child ASD are associated in a Swedish sample, taking into account co-occurring ADHD and ID. The third talk will discuss how ASD risk is related to cross-disorder risk of other psychiatric diagnostic groups, using a sibling design study from Israel. The fourth talk uses genetic data from two well-characterized samples to examine how common polygenic risk for ASD, educational attainment, schizophrenia, and intelligence are related. Attendees will come away with a greater understanding of the nosologic and etiologic implications in considering ASD with and without co-occurring ID.

10:30 **102.001** Do the Determinants of Autism Vary By Intellectual Disability? a Critical Review of the Concept of the Autism Spectrum and Its Relevance to Epidemiology

***D. Rai**[1], C. Magnusson[2] and C. Dalman[2], (1)School of Social and Community Medicine, University of Bristol, Bristol, United Kingdom, (2)Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden*

Background: Â Individual diagnostic categories of autism have now been subsumed into a single overarching category of an autism spectrum disorder in DSM-V. One of the arguments behind this move was that all types of autism, from Asperger syndrome to childhood autism may have a shared etiology. Although recent large epidemiologic studies support this argument for some putative environmental risk factors, for others, different or even divergent associations have been observed for autism with or without intellectual disability.
Objectives: Â The overall objective is to provoke thought and discussion by 1) providing a brief historical overview of the genesis of the concept of the autism spectrum; 2) critically discussing recent findings from a large Swedish cohort differentiating autism by the presence or absence of intellectual disability (ID); 3) reflecting on the utility and the strengths and weaknesses of carrying out epidemiologic studies aimed at studying the 'autism spectrum'.
Methods: The arguments will be discussed using published and unpublished empirical findings of investigations carried out within the Stockholm Youth Cohort, a large total population register based cohort based in Stockholm County, Sweden. Examples include results of studies investigating parental age, migration, socioeconomic status, parental depression, schizophrenia and bipolar disorder, infections, polycystic ovarian syndrome, gestational weight gain, fetal growth and antidepressant, folic acid and multivitamin use during pregnancy.
Results: The associations for advancing parental age, poor fetal growth, parental migration, Vitamin D deficiency, and maternal hospitalisation for infections during pregnancy were greater for autism with intellectual disability than for autism without ID. On the other hand, parental schizophrenia, bipolar disorder or maternal depression and antidepressant use have been reported to have stronger associations with autism without ID. Similar estimates of associations for autism with and without ID have been reported for parental socioeconomic status and gestational weight gain.
Conclusions:
The advantages of studying autism spectrum disorders as a combined group including larger samples and increased statistical power to study relationships with rare exposures will be discussed. On the other hand, it is possible that findings may be diluted where the associations differ markedly by the presence or absence of intellectual disability. The implications for the epidemiology of autism will be discussed.

10:50 **102.002** The Association of Paternal IQ with Autism Spectrum Disorders and Its Comorbidities

R. M. Gardner[1], *C. Dalman*[2], *D. Rai*[3], *B. Lee*[4] *and H. Karlsson*[5], *(1)Karolinska Institutet, Stockholm, SWEDEN, (2)Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden, (3)School of Social and Community Medicine, University of Bristol, Bristol, United Kingdom, (4)Drexel University, Philadelphia, PA, (5)Neuroscience, Karolinska Institutet, Stockholm, Sweden*

Background: Â Both Leo Kanner and Hans Asperger noted that the parents of the autistic children they originally described tended to be highly educated and intelligent, sewing the seeds of the hypothesis that Autism Spectrum Disorders (ASDs) are a case of "brilliance gone awry". The association between genetic risk for ASD and intelligence in the general population and the notable excess of ASD cases born to parents working in highly technical professions would seem to support this hypothesis.
However, results examining cognitive abilities amongst ASD cases and their family members have been mixed. One potential issue is that co-morbidities common to ASD, such ADHD and intellectual disability (ID) that are themselves heritable impairments of cognitive functions, are often not taken into account.
Objectives: Â Our goal was to examine the association between paternal intelligence and ASD, accounting for co-morbidity with ADHD and ID, in a population-based register study.
Methods: The study included 360,151 children, born 1984-2008, resident in Stockholm, Sweden, with a father that was conscripted to the Swedish military. Paternal IQ was measured on the stanine scale (1-9) during conscription at age 18. Paternal IQ subscale values (Logic, Verbal, Spatial, and Technical Reasoning) were available for 309,803 children. Children's diagnoses were recorded in Swedish health registers.
The association of paternal IQ with offspring risk for ASD, ADHD, ID and overlapping co-morbid groups was evaluated using restricted cubic spline models with paternal IQ=5 (average intelligence) as the referent, to allow flexible fitting of the relationship between paternal IQ and offspring risk for neurodevelopmental disorders.
Results: We observed a U-shaped relationship between paternal IQ and offspring risk of ASD with no co-morbidities ($OR_{IQ=1}$ 1.20, 95% CI 1.00–1.45; $OR_{IQ=9}$ 1.31, 1.14–1.50), after adjustment for socioeconomic status (SES). The association of low paternal IQ and ASD with co-morbid ID was stronger, though the overall relationship was similar ($OR_{IQ=1}$1.81, 1.29–2.54; $OR_{IQ=9}$ 1.30, 0.98–1.72). For ASD with co-morbid ADHD, only the association with low paternal IQ was apparent ($OR_{IQ=1}$ 1.49, 1.24–1.81; $OR_{IQ=9}$ 1.06, 0.88–1.28). The association between high paternal IQ and risk for offspring ASD alone was driven largely by the fathers' technical subdomain score ($OR_{Technical\ IQ=9}$ 1.51, 1.30–1.76). The association between paternal IQ and ID alone was striking ($OR_{IQ=1}$ 4.53, 3.68–5.57; $OR_{IQ=9Â}$ 0.66, 0.47–0.93), and a similar but weaker pattern was observed for ADHD alone ($OR_{IQ=1}$1.65, 1.50–1.82; $OR_{IQ=9Â}$ 0.71, 0.63–0.80). For all outcomes, similar results were observed before and after adjustment for the marked gradient in SES between paternal IQ levels. The associations of low paternal IQ with ASD or ADHD outcomes tended to be attenuated and the associations of high paternal IQ with ASD outcomes were strengthened when SES was considered.
Conclusions: Â High paternal IQ was indeed associated with children's risk of ASD, though this was most apparent in the group without co-morbidities. This risk was driven largely by the fathers' score on the technical sub-scale. Overall, the pattern for risk of ASD was distinct compared to that for ID or ADHD alone.

11:10 **102.003** Shared Genetic Risk Across Psychiatric Disorders

S. Sandin[1] *and A. Reichenberg*[2], *(1)Icahn School of Medicine at Mount Sinai, New York, NY, (2)Mount Sinai School of Medicine, New York, NY*

Background: Population based epidemiological studies have shown an association between autism spectrum disorder (ASD) and several other disorders including schizophrenia, psychosis and intellectual disability. Likewise, a variety of genetic studies in children with autism have genetic risk genes and loci shared with other, frequently co-morbid, psychiatric disorders. Genetic and family based studies have extended this also to other family members.
Where previous family-based studies focused either on one disorder as a risk factor for several other disorders or several other disorders as risks for one disorlder, the aim of this study was to assess in one large population a variety of psychiatric disorders both as risk factors and as outcomes. This was examined by the risk for psychiatric disorders in full siblings of probands diagnosed with a range of psychiatric disorders. To verify if the risk is specific to psychiatric disorders, we also assessed the ASD risk and the risk of other psychiatric disorders in siblings of probands with type-1 diabetes and siblings of probands with hernia, two heritable conditions. Not all countries and health systems can provide data to answer these questions. In our study we could use unique data from Israel, including information on family relations as well as clinically ascertained diagnoses of psychiatric disorders and potentially important confounding covariates.
Objectives: To utilize diagnostic data from screening of an entire population to further understand autism risk in relation to risk shared across other psychiatric diagnostic groups
Methods: The study population was recruited from all Israeli adolescents, ages 16-17, with at least one sibling and undergoing mandatory screening for eligibility to serve in the Israeli military, between the years 1998-2014. If the recruit is suspected of any relevant problems a comprehensive psychosocial examination is performed by a clinical social worker or psychologist and board-certified psychiatrist. Among individuals with an ASD diagnosis we calculated the risk of a selected psychiatric disorder in his/her sibling. Next, we repeated these calculations for all selected psychiatric disorders pairwise. We included the disorders: ASD (n=3400), psychotic disorder (n=9028), personality disorders (n=25,211), anxiety disorders (n=16,394), mood disorders (n=12,639), intellectual disability (n=13,667), low cognitive ability (n=23,226), type-1 diabetes (n=3638), and hernia (n=36,806). For each case we included 10 matched controls. We estimated relative risks of each disorder by the odds ratios from logistic regression. The odds ratios were calculated adjusted for sex, socio-economic status and year of birth.
Results: Siblings of probands with any of the psychiatric disorders were at increased risk for all psychiatric disorders examined and for low cognitive ability (most RRs ranging 2-3). For individuals with ASD the sibling RRs (95% confidence intervals) were estimated to be: for psychotic disorder, 3.4 (2.8-4.0); mood disorder, 2.4 (1.9-3.0); anxiety disorder, 2.9 (2.4-3.6); intellectual disability, 6.9 (6.0-7.9); ASD, 11.5 (9.2-14.4); hernia, 0.8 (0.6-0.9); and, diabetes, 1.0 (0.5-2.1).
Conclusions: There appears to be a large cross-sibling risk among individuals with different psychiatric diagnoses. Highest cross-sibling recurrence risk was observed for individuals with ASD, intellectual disability and psychotic disorder.

11:30 **102.004** Polygenic Transmission Disequilibrium Clarifies Common Variant Influences on Cognition in ASDs

D. J. Weiner[1,2]*, E. Wigdor*[1,2]*, M. Daly*[3] *and E. B. Robinson*[1,2]*, (1)Broad Institute, Cambridge, MA, (2)Analytic and Translational Genetics Unit, Department of Medicine, Massachusetts General Hospital and Harvard Medical School, Boston, MA, (3)Massachusetts General Hospital, Boston, MA*

Background: Autism spectrum disorders (ASDs) are genetically and phenotypically heterogeneous. Recent studies have associated ASDs with classes of genome-wide polygenic risk (PRS) that have diverse influences on cognition (Bulik-Sullivan, 2015 Nature Genetics). For example, ASDs are (i) positively associated with polygenic risk for educational attainment, which itself is positively associated with cognition and (ii) positively associated with PRS for schizophrenia, which is negatively associated with cognition. While genetic correlation analyses are not expected to be transitive, this inconsistent network of associations has raised the potential of confounding and case heterogeneity.
Objectives: The purpose of this analysis was to clarify common variant risk for ASDs, and to better understand the ASD subgroups for whom contributing polygenic risk factors are relevant. We developed a novel analytic technique called the polygenic transmission disequilibrium test (pTDT). Briefly, it is algebraically expected that, in any given set of parent-child trios, the mean of the offspring PRS distribution will equal the mean of the average parent PRS. This expectation is broken in the context of case ascertainment. For example, if a class of PRS (e.g., polygenic risk for educational attainment) is associated with ASD case status, we expect the PRS of ASD cases on average to significantly exceed average parent PRS. The pTDT is immune to confounding by ancestry or case ascertainment, and confers a substantial power advantage over traditional case-control polygenic risk scoring.
Methods: We conducted pTDT using two ASD family cohorts. First, we used the Simons Simplex Collection (SSC), a resource of more than 2,500 families with a child diagnosed with ASD. Second, we used an independent Psychiatric Genomics Consortium ASD (PGC ASD) sample that consisted of 3,870 parent-child trios. The PGC ASD cohort described here does not include individuals from the SSC. Using a standard approach, we calculated common polygenic risk for ASDs, educational attainment (EA) and schizophrenia (SCZ) for all genotyped family members in the SSC and PGC ASD datasets.
Results: We found that ASD cases over inherit polygenic risk for ASD, EA and SCZ ($p < 1.00E-15$ for each pTDT comparison), thereby unambiguously associating these classes of polygenic risk with ASD. In contrast, unaffected siblings on average inherit the expected polygenic burden for these three risk classes ($p > 0.05$ for each pTDT). ASD case over inheritance holds for ASD probands with and without intellectual disability ($p < 0.0005$ for each pTDT), as well as for probands with both intellectual disability and a *de novo* copy number or protein truncating variant ($p < 0.002$ for each pTDT). Finally, we find that EA PRS is positively associated with ASD case IQ, that SCZ PRS is negatively associated with ASD case IQ, and that ASD PRS is not associated with ASD case IQ.
Conclusions: These analyses suggest that ASD-associated common variant risk is etiologically relevant across the IQ distribution in ASDs. Different types of polygenic risk have distinct associations with IQ, which suggests they operate through at least partially distinct biological pathways.

Panel Session
103 - Brain Imaging and Cognition: Findings of the Longitudinal European Autism Project
10:30 AM - 12:00 PM - Yerba Buena 7

Panel Chair: Jan Buitelaar, *Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen Medical Centre, Nijmegen, Netherlands*

Discussant: Declan Murphy, *Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Autism Spectrum Disorder (ASD) is a common neurodevelopmental disorder but effective medical treatments for the core symptoms are still lacking. Although novel genetic and pre-clinical approaches are beginning to identify aetiology-based treatment targets there are still considerable challenges in testing them in clinical trials. This includes the need for objective diagnostic, stratification, and outcome measures that are accepted by international regulatory authorities. The EU-AIMS Longitudinal European Autism Project (LEAP) is a multi-centre, multi-disciplinary study to identify biomarkers that will allow stratification of patients into more biologically homogenous subgroups; and that may serve as surrogate endpoints. The European Medicines Agency (EMA) broadly endorsed the proposed population selection criteria and methodologies (cognitive, eye-tracking, EEG, MRI, FMRI, and biochemical biomarkers) for patient stratification (Loth et al., 2015). This panel will present the first results of the analyses of cognitive tasks, activation tasks using functional MRI, neural network architecture using resting-state MRI data and structural MRI data on volumetry, cortical thickness and surface area. The results will be discussed with the classical case-control paradigm, but also from the perspective of approaches for stratification of ASD.

10:30 **103.001** Identifying Cross-Domain Cognitive Subtypes Among Children, Adolescents and Adults with Autism Spectrum Disorders

E. Loth[1], *J. Ahmad*[2], *L. Mason*[3], *D. V. Crawley*[4], *H. L. Hayward*[5], *A. San Jose Caceres*[6], *B. Oakley*[6], *T. Charman*[2], *J. E. Tillmann*[2], *E. Jones*[7], *R. Holt*[8], *C. C. Bours*[9], *M. C. Lai*[10], *M. V. Lombardo*[11], *S. Baron-Cohen*[11], *M. H. Johnson*[12], *J. K. Buitelaar*[13], *D. G. Murphy*[14] *and G. Dumas*[15], *(1)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)CBCD, Birkbeck, University of London, Gravesend, UNITED KINGDOM, (4)Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (5)Forensic and Neurodevelopmental Sciences, Institute of Psychiatry Psychology and Neuroscience, King's College London, London, United Kingdom, (6)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (7)Birkbeck, University of London, London, UNITED KINGDOM, (8)Autism Research Centre, University of Cambridge, Cambridge, UNITED KINGDOM, (9)Department of Cognitive Neuroscience, Radboud University Medical Center, Nijmegen, The Netherlands, Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, Netherlands, (10)Psychiatry, University of Toronto, Toronto, ON, CANADA, (11)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (12)School of Psychology, Birkbeck College, London, United Kingdom, (13)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands, (14)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (15)Institut Pasteur, Paris, France*

Background: Â Autism Spectrum Disorders (ASD) are clinically and etiologically heterogeneous conditions. To make progress in identifying underpinning mechanisms it is essential to parse ASD into more homogeneous (biological) subgroups. However, most analytic approaches have focused on case-control differences - treating ASD as a unitary diagnostic entity. At the cognitive level, no single marker has been found that characterizes all individuals with ASD. Instead, impairments or differences have been reported in several aspects of social cognition, such as theory of mind, social motivation/ social attention, and in "domain-general" cognitive abilities, including aspects of executive function, and weak central coherence (WCC). However, findings are mixed and abnormalities often do not strongly relate to symptom severity. Arguably, an individual's profile of cognitive impairments (and strengths) across domains may be more predictive of symptom severity or adaptive functioning than abnormalities in a single domain.
Objectives: 1) To identify cross-domain cognitive profiles in a large sample of individuals with ASD who were assessed as part of the EU-AIMS Longitudinal European Autism Project (LEAP); and 2) To investigate whether different cognitive subtypes differ in their clinical symptoms.
Methods: Participants completed a battery of cognitive tests tapping explicit and spontaneous theory of mind (a continuous false belief task and the Animated Shapes task), social attention (% gaze time on faces), spatial working memory (SWM), probabilistic reversal learning (PRL), and WCC (Block Design). Across tasks, 349-435 individuals with ASD and 251-297 individuals with typical development (TD) or mild intellectual disabilities aged 6-30 years were included. First, we tested case-control differences on each task. Second, we estimated developmental growth curves by generating normative models for each TD participant's [task score] relative to their age using Gaussian Processes for Machine Learning. For each participant with ASD we then quantified the deviation from the normative model. Finally, to identify cognitive subtypes, we used hierarchical clustering based on each individual's deviations from the means across all tasks.
Results: We found significant mean group differences in social attention (p=.002, d=.26) PRL (p<.0001, d=.35) and SWM (p<.0001, d=.43). However, normative modelling revealed that on the SWM task 66% of participants with ASD performed within +/-1 SD of the age-expected TD means or above; 19.7% fell between 1-2 SDs and 12.8% below 2 SDs. These patterns were very similar for the PRL and social attention measures (Figure 1). Hierarchical clustering (including only participants who completed all tasks) revealed 6 distinct clusters (Figure 2), which partly differed in their symptom presentation. For example, Cluster 6 (impaired ToM+ "intact" EF+ WCC) had on average significantly fewer repetitive behaviors than Cluster 3 (impaired social attention+ impaired SWM) and higher levels of adaptive behaviour than Clusters 3 and 2 (impaired reversal learning + other impairments), perhaps reflecting their ability to recruit 'intact' EF skills as a compensatory mechanism.
Conclusions: Â Using a battery of 'classic' ASD-related cognitive tasks, we show distinct cognitive profiles among people with ASD, with partly differing clinical symptoms. These results point to the value of stratification approaches to reduce heterogeneity, to refine both aetiology and intervention.

10:50 **103.002** The Neuroanatomy of ASD in a Large and Clinically Heterogeneous Sample – Preliminary Results of the EU-AIMS Longitudinal European Autism Project (LEAP)

C. Ecker[1,2], *R. Toro*[3], *D. Goyard*[4], *D. Andrews*[5], *E. Loth*[6], *J. K. Buitelaar*[7,8,9], *D. G. Murphy*[2] *and A. Grigis*[10], *(1)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychiatry, Goethe-University Frankfurt am Main, Frankfurt, Germany, (2)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Institut Pasteur, Paris, FRANCE, (4)Neurospin, CEA, Université Paris-Saclay, Gif sur Yvette, France, (5)King's College London, London, UNITED KINGDOM, (6)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (7)Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, Netherlands, (8)Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen Medical Centre, Nijmegen, Netherlands, (9)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands, (10)UNATI, Neurospin, CEA, Universite Paris-Saclay, Gif-sur-Yvette, France*

Background: Evidence suggests that Autism Spectrum Disorder (ASD) is accompanied by neurodevelopmental differences in brain anatomy and connectivity. Across studies, however, the size of reported effects is often inversely correlated with sample size (i.e. larger effects are typically reported by studies examining a small number of participants). It is thus currently under debate whether findings replicate in large and clinically heterogeneous samples of individuals, and which particular aspects of the cortical architecture underlying ASD are most representative of the broader ASD phenotype in the general population.
Objectives: Here, we therefore examined differences in various aspects of brain anatomy in a large and heterogeneous sample of ASD individuals, acquired across multiple acquisition sites within Europe, in order to (1) determine which neuroanatomical characteristics best represent the ASD phenotype in the general population, (2) to characterize differences in developmental trajectories, and (3) to examine the extent to which demographic variables such as biological sex may affects the neuroanatomy of ASD.
Methods: Across six European sites, we collected structural Magnetic Resonance Imaging (MRI) scans on 350 well-characterized individuals with ASD (*n*=254 males, *n*=96 females, mean age = 17.49+5.59 years, FSIQ = 99.28+19.47), and 255 typically developing (TD) controls (*n*=159 males, *n*=96 females, mean age = 17.34+5.87 years, FSIQ = 105.13+17.41). All individuals with ASD were diagnosed using gold-standard assessment tools for ASD (i.e. ADI-R, and ADOS). The FreeSurfer software suite (v.5.3) was utilized for data pre-processing, and to derive a set of neuroanatomical features that included total grey and white matter volumes, subcortical volumes, and surface-based morphometric features (cortical thickness (CT) and surface area (SA)). Multivariate general linear models were used to examine (1) between-group differences, (2) differences in neurodevelopmental trajectories on the global and local (i.e. vertex-wise) level of brain anatomy, and (3) diagnosis-by- sex interactions.
Results: Overall, we found that individuals with ASD did not differ significantly from TD controls in total grey and white matter volumes, total intracranial volume, or cerebrospinal fluid (p>0.05, two-tailed). There were also no significant between-group differences in the volumes of subcortical structure following correction for multiple statistical comparisons. On the vertex level, we confirmed that individuals with ASD have significant - and mostly non-overlapping - differences in CT and SA (Figure 1), which mediated differences in regional brain volume. As expected, within our observed age range (6.81–30.78 years), both CT and SA displayed complex (i.e. non-linear) neurodevelopmental trajectories, where ASD individuals significantly differed from controls. Last, we report significant sex-by-diagnosis interactions in surface anatomy, thus confirming that the neuroanatomy of ASD is significantly modulated by biological sex.
Conclusions: Taken together, when examining the neurobiological underpinnings of ASD in a large and clinical heterogeneous sample of individuals, our findings suggest that ASD is best characterized by regional differences in CT and SA. This is of importance as CT and SA have different neurodevelopmental origins, and may therefore be used to stratify individuals into genetically and/or phenotypically distinct subgroups. Moreover, these differences vary across the human life span, and also differ between men and women.

11:10 **103.003** A Multi-Site Investigation of Functional MRI Responses in the Longitudinal European Autism Project (LEAP) Cohort

C. Moessnang[1], *S. Baumeister*[2], *D. Goyard*[3], *K. Otto*[1], *S. Baron-Cohen*[4], *S. Durston*[5], *A. M. Persico*[6], *W. Spooren*[7], *D. G. Murphy*[8], *E. Loth*[9], *J. K. Buitelaar*[10], *T. Banaschewski*[11], *D. Brandeis*[2], *H. Tost*[1] *and A. Meyer-Lindenberg*[12], *(1)Department of Psychiatry and Psychotherapy, Central Institute of Mental Health, University of Heidelberg, Mannheim, Germany, (2)Department of Child and Adolescent Psychiatry and Psychotherapy, Central Institute of Mental Health, Mannheim, Germany, (3)Neurospin, CEA, Université Paris-Saclay, Gif sur Yvette, France, (4)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (5)Rudolf Magnus Institute of Neuroscience, University Medical Center Utrecht, Utrecht, NETHERLANDS, (6)University of Messina, Rome, ITALY, (7)Roche Pharmaceutical Research and Early Development, NORD Discovery and Translational Area, Roche Innovation Center, Basel, Switzerland, (8)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (9)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (10)Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, Netherlands, (11)Central Institute of Mental Health, University of Heidelberg, Heidelberg, GERMANY, (12)Central Institute of Mental Health, Mannheim, Mannheim, Germany*

Background: A major goal of neuroimaging research in autism spectrum disorder (ASD) is the characterization of differential task-related neural responses in large-scale cognitive systems, which hitherto has yielded inconsistent findings. A likely reason is the heterogeneity of the disorder which has been insufficiently addressed in smaller-sized samples.
Objectives: As part of the Longitudinal European Autism Project (*LEAP*), we aim at identifying markers of aberrant neural processing in four major cognitive systems (emotion processing, Theory of Mind [ToM], executive control, reward processing) using task-based functional magnetic resonance imaging (fMRI) in a large cohort of ASD and typically developing (TD) subjects.
Methods: A task battery was designed which taps into core ASD deficits, allows for the inclusion of children and less able subjects and meets test-retest reliability criteria for the use in an accelerated longitudinal design including two measurement time points. FMRI was performed at six European centers following standard operations procedures. A total of 672 subjects (6-30 years, 58% ASD, 69% male) participated in the fMRI assessment and tasks were selected according to the individual's ability level. The task battery included a social and monetary reward task, a spontaneous mentalizing task involving animated shapes, an emotional face-matching task, and a flanker/GoNogo task. Baseline assessment was performed between April 2014 and September 2016, and a 12-24 month follow-up is currently under way. A quality control pipeline has been implemented and applied to the data in order to assess effects of site, diagnosis and age on raw data quality. First pass analyses have been performed using standard processing routines implemented in SPM12 (http://www.fil.ion.ucl.ac.uk/spm/).
Results: Â Quality assessment identified prominent effects of site on raw data QC metrics, with no or only modest interaction with diagnosis and age. Motion was elevated in ASD subjects and in younger children across tasks. Preliminary statistical analyses performed within the framework of the General Linear Model revealed robust activation of each of the networks of interest, while simple case-control differences did not pass the significance threshold (p<0.05, family-wise error corrected across the whole brain).
Conclusions: The LEAP cohort represents the largest European task-based fMRI data set on autism. The employed tasks successfully engaged functional activation within four major cognitive systems. In addition, first-pass analyses suggest that a thorough investigation of different sources of variance is warranted. This not only includes the control of various sources of noise (e.g. between-site differences, motion), but also the application of sample stratification procedures in order to address the hypothesized heterogeneity of the sample (e.g. symptom profiles, interaction with sex and age). These analyses will set the stage for an in-depth investigation of the autism phenotype in various functional imaging measures, ranging from regional activation to network-based connectivity metrics.

11:30 **103.004** Analysis of the Resting-State fMRI Data of the EU-AIMS Longitudinal European Autism Project (LEAP)

M. Oldehinkel[1,2], *M. Mennes*[1], *C. F. Beckmann*[1,3] *and J. K. Buitelaar*[1,2,4], *(1)Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, Netherlands, (2)Department of Cognitive Neuroscience, Radboud University Medical Centre, Nijmegen, Netherlands, (3)Centre for Functional MRI of the Brain, University of Oxford, Oxford, United Kingdom, (4)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands*

Background: Studies applying resting-state functional magnetic resonance imaging (R-fMRI) to investigate functional connectivity in autism spectrum disorders (ASD) have revealed mixed results. Interpretability of findings is further limited by the use of small sample sizes and the focus on a limited number of resting-state networks (RSNs). In this study we used R-fMRI data from 486 participants of the multicentre Longitudinal European Autism Project (LEAP) to investigate ASD-related changes in functional connectivity of 20 large-scale RSNs.
Objectives: To provide a comprehensive characterization of ASD-related alterations in functional connectivity within and between 20 RSNs in a large ASD cohort using 1) classical case-control comparisons and 2) dimensional analyses based on autism severity scores.
Methods: Good quality R-fMRI data was available for 265 ASD participants and 221 controls (age range: 7-30 years). We derived 20 RSNs by applying independent component analysis (FSL Melodic) to R-fMRI data from 75 control participants. Next, we obtained the subject-specific RSNs for each of the remaining participants (FSL dual regression) and compared functional connectivity within these 20 RSNs between the control group and ASD group (categorical analysis). In addition, we correlated functional connectivity within the 20 RSNs to the total score of the social responsiveness scale (SRS) across all participants (to investigate functional connectivity across the ASD continuum; dimensional analysis). In both analyses we applied permutation testing (N=5000; FSL Randomise) and corrected for multiple comparisons (i.e., correcting for testing 20 RSNs using Bonferroni). In addition, we computed Pearson correlations between the timeseries of the 20 RSNs to investigate categorical and dimensional ASD-related changes in between-network connectivity (5000 permutations, FDR-corrected). In all analyses we corrected for effects of scan site, age, gender and head motion.
Results: We obtained 20 RSNs that included common sensory, motor, default-mode, and task-related networks (Figure 1). We did not observe differences in functional connectivity within the 20 RSNs between the ASD and control group. Yet we did observe a significant association in the dimensional analysis: functional connectivity within the medial motor network increased at higher SRS scores (i.e., higher ASD severity scores). Furthermore, the between-network analysis revealed that functional connectivity between the lateral visual network and the auditory, lateral motor, and somatomotor network was decreased in the ASD compared to control group (Table 1).
Conclusions: Our findings suggest that the integration of information from different sensory modalities is disturbed in ASD, which might lead to the abnormalities in sensory processing in ASD. The increased functional connectivity within the motor network might further be related to the repetitive motor behaviors in patients with ASD. Importantly, the relatively limited amount of ASD-related alterations in functional connectivity observed in this large cohort points to a potential large heterogeneity among ASD patients and warrants caution when generalizing results from small sample R-fMRI studies in ASD to the general population. Accordingly, future work will focus on stratification of ASD patients and the investigation of developmental effects in ASD.

Panel Session
104 - Measuring and Predicting Quality of Life in Older Adults with Autism
10:30 AM - 12:00 PM - Yerba Buena 8

Panel Chair: Dermot M. Bowler, *City, University of London, London, United Kingdom*

Although it is widely accepted that the quality of life (QoL) of individuals with ASD is adversely affected in adulthood, particularly towards the later end of the life span, systematic research in this area is scarce. We know little about how to measure the QoL of individuals on the autism spectrum effectively nor about whether the conceptual framework of typical QoL translates easily to the context of ASD. There are also gaps in our knowledge about the wider pattern of factors that are associated with differences in QoL or whether or not there are any autism-specific associations with QoL. The papers in this panel tackle conceptual and practical issues relating to the measurement of QoL in later-life ASD as well as reporting whether factors, such as prospective memory, that are known affect QoL in the typical population operate similarly in ASD. The work reported here represents an important step forward in our understanding of autism in later life

10:30 **104.001** Successfully Engaging with Adults on the Autism Spectrum and Their Relatives about Longitudinal Cohort Research

J. Parr[1], *A. Petrou*[2], *J. E. Mackintosh*[3], *D. Mason*[4], *J. Hamilton*[5], *C. Michael*[6], *T. Goth*[7], *C. Mitchell*[7], *D. Garland*[8], *T. Finch*[7], *A. Le Couteur*[9] *and H. McConachie*[4], *(1)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom, (2)Newcastle University, Newcastle Upon Tyne, UNITED KINGDOM, (3)Newcastle University, Newcastle upon Tyne, UNITED KINGDOM, (4)Institute of Health and Society, Newcastle University, Newcastle upon Tyne, United Kingdom, (5)Northumberland, Tyne and Wear NHS Foundation Trust, Newcastle Upon Tyne, United Kingdom, (6)Autism Age, Notrwich, UNITED KINGDOM, (7)Newcastle University, Newcastle-upon-Tyne, United Kingdom, (8)National Autistic Society, Newcastle upon Tyne, United Kingdom, (9)Northumberland, Tyne and Wear NHS Foundation Trust, Newcastle Upon Tyne, UNITED KINGDOM*

Background: Little is known about how autism is experienced in adulthood or its impact across the life-course. Guidance about undertaking research with autistic adults and relatives is scarce. In setting up the Autism Spectrum Cohort-UK (ASC-UK), we learned many things about how to undertake longitudinal research with adults and relatives – this presentation aims to disseminate that learning, so other groups might benefit and set up successful research partnerships.
Objectives: 1. To disseminate information about a stakeholder-informed research approach for the meaningful engagement of autistic adults, and relatives, in a cohort study; 2. Show how this process has led to excellent recruitment into the cohort, and some early findings.
Methods: Between 2013-4, a series of consultations with around 50 autistic adults and relatives was held over a two year period; 'learning points' were extracted from notes of those meetings. From 2015, adults and relatives were recruited to ASC-UK from a network of over 100 UK National Health Service, Voluntary sector and autism community organisations. As part of mixed methods research, data were collected from all participants using a baseline questionnaire, plus the SRS and the WHOQoL-BREF. Interviews with 30 autistic adults were completed by one researcher, transcribed and coded.
Results: *Preparation for research***:** Recommendations included having autistic adults as paid researchers/advisors, and the development of 'user-friendly' research processes. Ways to include individuals with intellectual impairment were suggested. Questionnaire development focused on font size, spacing, and using plain text.Â A key point was emphasising the utility of the research for adults. The following were amongst the recommendations suggested for direct working: Use alternative ways to exchange information (e.g. text messages, emails, face-to-face discussions); give extra time in discussions and interviews for information processing; use visual materials; consider the sensory impact of interview venues. *Recruitment progress and initial study findings:* After 20 months recruitment, 990 autistic adults and relatives joined the cohorts (including 750 autistic adults, 50 of whom lacked capacity to consent for themselves); 50 adults per month joined in 2016. For the autistic adult cohort, men and women participated in equal numbers; median age was 39 years, range 17-86 years; 25% aged >55 years. Adults on the autism spectrum reported about their current mental health (depression in 47%, anxiety in 50%), and access to services – fewer than half had received the services they needed. Qualitative interviews revealed many themes that people thought important about the quality of their lives including: the importance of routines, the impact of supportive and non-supportive relationships, how a diagnosis led to people making sense of their lives, learning how to act to fit in with others, missed opportunities and achievements, managing responses to others.
Conclusions: Our findings emphasise the importance of utilising the expertise of autistic adults and relatives within the research team. This has led to effectiveness in involving, recruiting and engaging people to participate in the cohort study. In turn that has led to effective research providing detailed data about the quality of the lives of adults on the autism spectrum, and their relatives.

10:50 **104.002** Is the Whoqol-Bref Fit for Purpose in Measuring Quality of Life in Autistic Adults?

H. McConachie[1]*, D. Mason*[1]*, D. Garland*[2]*, C. Wilson*[3]*, A. Petrou*[4]*, J. Rodgers*[4] *and J. Parr*[4]*, (1)Institute of Health and Society, Newcastle University, Newcastle upon Tyne, United Kingdom, (2)National Autistic Society, Newcastle upon Tyne, United Kingdom, (3)autism advocate, Sunderland, United Kingdom, (4)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom*

Background: There is urgent need for health-related research with autistic adults to better understand their needs, lived experience and views. Furthermore, there is a lack of specifically validated outcome measures, in particular for measuring quality of life (QoL). Current research findings about QoL are inconsistent regarding which domains of QoL are most affected in autistic adults, and how QoL may vary with age is unclear.
Objectives: To examine the appropriateness of measuring quality of life of autistic adults with the World Health Organisation brief quality of life scale (WHOQoL-BREF).
To explore particular issues affecting quality of life in older adults on the autism spectrum.
Methods: Participants are members of the Adult Autism Spectrum Cohort (ASC-UK) involved in a longitudinal study of life experiences. Each adult (or proxy where the adult lacks capacity to consent for themselves) completes a baseline questionnaire, the Social Responsiveness Scale, and the WHOQoL-BREF. An exploratory factor analysis was conducted (n = 370) to examine the WHOQoL-BREF's structural validity for autistic adults, i.e. whether the same four subscales (social, psychological, physical, environment) emerge. Experiences and quality of life of older adults (61+ years) and younger adults were compared.
Qualitative information was obtained about determinants of individuals' quality of life, about the importance and interpretation of the items of the questionnaire, and about the suitability of the additional WHO Disabilities module (Power et al 2010) through in-depth interviews, focus groups and cognitive interviewing. Further items relevant to the experience of autistic adults were tested for importance and clarity in a Delphi survey, and all the items tested in a large validation study with the ASC-UK cohort.
Results: A five-factor model emerged showing considerable overlap with the WHO subscales (the physical subscale separating in two). Moderate to good internal consistency was found for the four subscales. In focus groups, some items were found difficult to interpret or suggested as relatively unimportant. Other items were discussed with a different slant, such as '*How satisfied are you with your capacity for work?*' where participants put emphasis on whether employers understood autism or had stereotyped views.
The individual interviews elicited themes from older adults which often reflected health issues, their own or of other members of the family. Some people had gained a positive outlook through obtaining a diagnosis later in life. Older and younger autistic adults on average reported similar QoL, except on the social subscale where older adults reported poorer QoL.
Conclusions: The WHOQoL-BREF appears largely appropriate for measuring quality of life in autistic adults. However, additional Disabilities items give a fuller picture of specific experiences related to autonomy, control and discrimination, as well as newly derived autism-specific items including other people's lack of understanding of autism, financial insecurity and the specific support structures needed by individuals. For older adults, health issues loom large, either for themselves or requiring them to take on a carer role in the family. As autistic adults, they may have great difficulty in asking for and finding appropriate sources of support and health services.

11:10 **104.003** Do ASD Adults Become Happier When Older?

H. M. Geurts*, University of Amsterdam, Amsterdam, NETHERLANDS*

Background: Given the lack of knowledge regarding older ASD adults, researchers, ASD adults, and their relatives agreed that we need to study what the future holds for those with ASD. This is especially important as life-span subjective well-being is reported to be low. Most earlier studies did not include older individuals with ASD (i.e., >50 years) and were cross-sectional in nature. Moreover, several factors (e.g., ASD-severity, IQ, comorbidity) are thought to be relevant to subjective well-being, but the interaction among potentially relevant factors is often ignored. Recently we showed that focusing on the multivariate pattern of these factors is needed to enhance our understanding of subjective well-being in ASD.
Objectives: First, to provide an overview of a series of recent cross-sectional studies in which we focused on subjective well-being in ASD adults. Second, to explore longitudinally the (interaction of) predictors of change in subjective well-being in mid- and old-aged ASD adults.
Methods: A total of 122 (80 males) mid- and old-aged ASD adults (M=53.8, range 31-80 years) were assessed 1 to 4 years (M=3.1 years; T2) after they participated in a large cross-sectional study (T1; Lever & Geurts, 2016). For this abstract, we conducted an exploratory regression analyses with self-reported ASD-symptomatology (AQ), comorbid symptomatology (SCL-90), and educational level at T1 as predictors of change in subjective well-being (WHO-QoL short version, four scales). Please note that network analyses are the planned analyses in which psychotropic medication use (yet to be scored) and occupational status (yet to be scored) will also be included as network factors.
Results: When focusing on the change score (T2-T1) there are large individual differences. Depending on the WHO-QoL subscale 16 to 24% do have a similar score at both time-points. Individuals showing an increase or a decrease were equally prevalent. The exploratory regression models explained hardly any variance, and none of the predictors were statistically significant.
Conclusions: The subjective well-being in mid- and old-aged ASD adults is lower when compared to those without ASD and often changes with age. However, the directionality of these changes differs across individuals. Although, the reported analyses are preliminary, so far the tentative conclusion is that ASD-, comorbid symptomatology, and one's educational level do not seem to be relevant factors to predict the observed change. The results of the aforementioned network analyses will be discussed, as well as alternative predictors.

11:30 **104.004** Prospective Memory and Quality of Life in Older Adults with Autism.

A. Roestorf[1]*, S. B. Gaigg*[1]*, P. Howlin*[2]*, C. Povey*[3] *and D. M. Bowler*[1]*, (1)Psychology, City, University of London, London, United Kingdom, (2)King's College London, Institute of Psychiatry, London, UNITED KINGDOM, (3)The National Autistic Society, London, UNITED KINGDOM*

Background: Prospective memory (PM) is 'remembering-to-remember', or remembering to do something in the future (Brandimonte et al., 1996). In neurotypically ageing (NT) adults, PM is crucial to healthy and independent ageing (d'Ydewalle et al., 2001; Henry et al., 2004) and is a significant factor in preventing age-related memory decline (Maylor, 1996), as well as being one of the most important predictors of quality of life (QoL) (Woods, 2015). PM can involve event-based (EBPM) remembering supported by external referencing cues, and time-based (TBPM) remembering which is reliant on internal self-referencing.
Limited research on PM in ASD has been conducted with children and young adults, using computerised and pseudo-naturalistic paradigms in lab settings. PM studies with ASD adults report variable difficulties in intention formation, rule adherence and everyday memory, compared to non-autistic adults (Altgassen et al., 2012; 2013; Williams et al., 2014). However, the majority of these studies combined EBPM/TBPM assessment in single tasks, involving social demands – remembering something related to someone else (e.g. experimenter), which may have disadvantaged autistic adults to a greater extent than non-autistic individuals.
Objectives: This is the first ASD-related study evaluating the role of social motivation (self-relevant vs other-relevant) in lab-based and truly naturalistic settings and age-related differences in PM, everyday functioning and QoL.
Methods: Forty-nine adults with a diagnosis of ASD and 38 NT adults in a comparison group matched on age (19-80 years) and IQ (>70, mean 115, SD 14) are involved in 4 within-group studies in this extended programme of work. Studies 1 and 2 evaluate (1) EBPM and (2) TBPM ability as separate tasks embedded in a computerised lexical decision paradigm in a lab setting. Studies 3 and 4 explore (3) EBPM and (4) TBPM for (3a, 4a) self-relevant and (3b, 4b) other-relevant tasks in a naturalistic environment, during the course of everyday activities such as participants having to remember to phone in information in a given number of days' time. QoL was measured by WHOQoL-BREF.
Results: Preliminary analyses show the ASD group made fewer accurate but slower PM responses (p<.001) under increased demands of an ongoing lexical decision task (p<.05). Moreover, PM difficulties were highly correlated with poorer physical quality of life in the ASD group (p<.001). The studies are ongoing and our full data will be available by March 2016. Our predictions are based on our recent *Ageing with Autism* work (Roestorf & Bowler, 2016).
We predict: (i) poorer TBPM than EBPM in all ASDs; (ii) impaired EBPM in all ASDs compared to TD comparison groups; (iii) poorer TBPM in younger ASDs compared to TDs but (iv) no differences between the older ASD-TD groups; and (v) no group differences in 'self-relevant' task performance, but (vi) impaired 'other-relevant' task performance in ASDs compared to TDs.
Conclusions: Our findings will enhance our understanding of the role of age-related differences in QoL and different types of PM autistic adults, thus informing the challenges and benefits of growing older with autism.

Panel Session
105 - Towards Elucidating Early Causal Mechanisms of ASD: New Directions for Prospective Longitudinal Studies
10:30 AM - 12:00 PM - Yerba Buena 9

Panel Chair: Emily Jones, *Birkbeck, University of London, London, UNITED KINGDOM*

Discussant: Terje Falck-Ytter, *Dept of Psychology, Uppsala University, Uppsala, Sweden, Dept of Psychology, Uppsala University, Uppsala, Sweden*

Prospective longitudinal studies of high-risk infants have provided a nuanced characterisation of behavioural symptom emergence in infancy and toddlerhood. However, our understanding of the causal neurodevelopmental mechanisms remains limited. We present four theoretically motivated approaches designed to provide insight into mechanisms underlying symptom onset. Our first speaker acquires brain structural, functional and biochemical data from fetuses, neonates and infants with and without risk factors for neurodevelopmental conditions. She will present preliminary evidence of differences in regional brain structure and function and maturation of the glutamate system in these risk groups. Second, we showcase recent work demonstrating that patterns of EEG observed in 3-month-old infants at high risk for developing autism and who are subsequently diagnosed with autism at age 3 differ from infants who do not develop autism. Third, we show that alterations in infants' pupillary light reflex – a basic measure putatively linked to the cholinergic system – may relate to later ASD outcomes. Finally, we will present recent work on altered experience-dependent specialisation of the social brain in early ASD, including new data linking variation to sensory processing atypicalities. Taken together, these talks identify new avenues for generating fundamental insights into the mechanisms that drive symptom onset in ASD.

10:30 **105.001** Applying MRI to Map Typical and Potentially Atypical Brain Development at Fetal, Neonatal and Infant Time-Points

G. M. McAlonan, *Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: Until now, we have had few tools to explore early human brain development *in vivo*. This is changing with the advent of sophisticated but safe, Magnetic Resonance (MR) techniques that can be applied at fetal, neonatal and infant stages of development.
Objectives: We aim to acquire brain structural, functional and biochemical data from infants with and without a family history (parent or sibling) of Autism Spectrum Disorder (ASD) from before birth through to 6 months of age. We will first test the hypothesis that a familial risk of ASD causes differences in brain maturational indices. When outcome data becomes available, we will test the hypothesis that these brain maturational differences predict the later appearance of autistic behaviours.
Methods: Advanced MRI protocols at 3Tesla have been optimized for very young children and fetuses. Structural, resting-state functional and magnetic resonance spectroscopy datasets are in progress. At the time of writing data is available for approximately n = 50 fetuses (at approximately 34 weeks gestation); n = 60 neonates; n = 50 6 month old infants; and increasing. A number of these children have been scanned on at least 2 occasions. Approximately half have a family history of ASD. We are currently characterizing brain maturation profiles across the whole group and also testing for potential between group differences. In addition, the infants are invited to return for follow-up developmental assessments (including for traits of ASD), until the age of 3- years, at which time we will examine whether brain indices in very early life predict later childhood outcomes.
Results: I will present preliminary evidence for group differences in brain structure and function and maturation of the glutamate system in very young children at risk of ASD. There appears to be a concentration of differences in the subcortical and interconnected brain regions.
Conclusions: This data will contribute to the longer-term objective to identify early imaging biomarkers which predate and help predict neurodevelopmental outcomes (adverse or not) in childhood.

10:50 **105.002** EEG Variability at 3 Months Correlates with Autism Outcomes

A. R. Levin[1], *H. M. O'Leary*[1], *A. S. Mendez Leal*[2], *A. Acosta*[3], *K. J. Varcin*[4], *J. M. Mayor Torres*[5], *H. Tager-Flusberg*[6] *and C. A. Nelson*[7], *(1)Neurology, Boston Children's Hospital, Boston, MA, (2)Harvard College, Cambridge, MA, (3)Harvard, Cambridge, MA, (4)Telethon Kids Institute, Perth, Australia, (5)Harvard Medical School, Cambridge, MA, (6)Psychological and Brain Sciences, Boston University, Boston, MA, (7)Boston Children's Hospital, Boston, MA*

Background:
There are now a plethora of studies using EEG to elucidate neural connectivity in autism. While within-subject variability in EEG responses to repetitive stimuli are often thought to be a barrier to be overcome in such studies, recent work suggests that variability itself may be an important marker of underlying neurobiological processes, rather than a barrier to be overcome. To this end, elevated intra-participant variability in response to repetitive trials has now been demonstrated in multiple studies of children with autism spectrum disorder (ASD).[1]
Increasing evidence also suggests that alterations in brain development during infancy precede the manifestation of overt, behavioral signs of autism spectrum disorder (ASD). A key finding in infant studies, however, is that findings present in children with ASD may be different from findings in infancy that portend a later ASD diagnosis. For example, prior studies from our group have shown that high frequency frontal power is decreased in 3-month-old infants at high risk for ASD, but increases excessively over the first 3 years of life in infants who later develop ASD.
Here, we therefore assess the extent to which trial-by-trial within-participant variability, previously shown to be elevated in children and adults with ASD, is altered in infants who are later diagnosed with ASD.
Objectives: We analyzed response variability in 3-month-old infants later diagnosed with ASD, compared to infants who were later found not to have ASD.
Methods: ERP data were acquired on 3-month-old infant siblings of children with ASD (high risk; HRA; n = 41) and 3-month-old low risk controls (LRC; n = 16) as part of a prospective, longitudinal investigation. For each infant, we used inter-trial alpha phase coherence (ITPC) to measure variability of the P150 response across trials to a standard native consonant-vowel auditory stimulus (/da/). Diagnosis of ASD(+) or lack thereof(-) was determined at 24-36 months using the Autism Diagnostic Observation Schedule (ADOS) and best clinical estimate (HRA+: n = 11; HRA-: n = 14; LRC-: n = 16).
Results: 3-month-olds later diagnosed with ASD had significantly increased P150 response variability ($p < .05$), compared to 3-month-olds later found not to have ASD.
Conclusions: Increased intra-individual response variability to a repetitive stimulus is present in 3-month-olds who will later develop ASD. This suggests that excessive variability is present prior to the onset of behavioral manifestations of ASD, and thus may be an early marker of altered brain function on the pathway to ASD symptoms.
References:
1. David N, Schneider TR, Peiker I, Al-Jawahiri R, Engel AK, Milne E. Variability of cortical oscillation patterns: a possible endophenotype in autism spectrum disorders? *Neurosci Biobehav Rev*. 2016.

11:10 **105.003** Enhanced Pupillary Light Reflex in Infancy Predicts Elevated Autistic Symptoms at Two Years of Age

T. Falck-Ytter[1,2], *P. Nyström*[3], *E. Nilsson Jobs*[3], *G. Gredebäck*[3] *and S. Bolte*[1], *(1)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Institutionen för kvinnors och barns hälsa (KBH), Karolinska Institutet, Stockholm, Sweden, (2)Dept of Psychology, Uppsala University, Uppsala, Sweden, (3)Uppsala University, Uppsala, SWEDEN*

Background:
We recently discovered that ten-month-old siblings of children with autism spectrum disorder (ASD) had stronger pupillary light reflexes compared to low risk control infants (Nyström et al., 2015, Molecular Autism), a result which contrasts sharply with the weak pupillary light reflex typically seen in both children and adults with ASD. This finding raises the possibility that the pupillary light reflex captures early neurodevelopmental processes associated with autism risk. According to one hypothesis, atypicalities in the pupillary light reflex reflect a dysregulation in the cholinergic system, which is disrupted in ASD and plays a key role in the regulation of excitatory-inhibitory balance early in life.
Objectives: We followed up the infants in our previous study to an age when ASD outcome could be assessed. Based on the result of our previous study we predicted that infants who later developed high levels of ASD symptoms would have stronger pupillary light reflexes than other infants.
Methods: The pupillary light reflex was assessed using non-invasive eye tracking and the amplitude and latency was calculated in accordance with Nyström et al. (2015; Molecular Autism). 49 infants were included in the final sample. At 24 month of age, the Autism Diagnostic Observation Schedule, second edition (ADOS-2) was administered. ADOS standardized calibrated severity scores (CSS; range 1-10) were calculated, where scores in the 6-10 range indicate moderate-to-severe concern for ASD (Esler et al, 2015, JADD). We classified individuals in the high risk group with scores in this range as ASD positive (n = 6). Remaining infants were either ASD negative (n = 29) or low risk controls (n = 14).
Results: We found that the amplitude of the pupillary light reflex was larger in 10-month-olds who were classified as ASD positive at 24 months compared to unaffected high risk infant siblings – who in turn had larger amplitudes compared to infants with no family history of ASD (both *P*s <.05).
Conclusions: This study indicates that dependent on its magnitude, the pupillary light reflex in infancy signals either sub-threshold ASD risk or full-blown clinical symptoms, and suggests that pupillometry can facilitate risk assessment in human infants.

11:30 **105.004** Sensory Hypersensitivity Predicts Enhanced Attention Capture By Faces in the Early Development of ASD

E. Jones[1], *G. Dawson*[2] *and S. J. Webb*[3], *(1)Birkbeck, University of London, London, UNITED KINGDOM, (2)Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC, (3)University of Washington, Seattle, WA*

Background: Sensory symptoms are highly prevalent in young children with ASD, but their relation to the canonical social communication symptomatology is unclear. Recently, sensory hypersensitivities have been linked to increased allocation of attention to low-level sensory stimuli within the neural salience network (Green et al., 2016). Since people possess many salient low-level features that drive attention capture in early development (e.g. motion, audio-visual synchrony, and relative unpredictability), we reasoned that greater levels of hypersensitivity should predict *greater* early attentional responses to social stimuli. Further, since social attention is thought to promote more optimal social development, we predicted that greater early attentional responses to social stimuli should predict greater social approach within a group of children with ASD.
Objectives: In two longitudinal samples, we tested whether early sensory hypersensitivity predicts later enhanced attention capture by faces, and whether this in turn predicts better social approach within groups of children with ASD.
Methods: We used questionnaire measures to assess sensory hypersensitivity (the perceptual sensitivity subscale of the Infant Behavioral Questionnaire and a composite measure of sensory hypersensitivity from the Sensory Profile) in two cohorts respectively: n=88 infants at low and high familial risk for ASD tested at 6, 12 and 18 months; and n=48 toddlers with ASD tested at 2, 3 and 4 years. Neural attention capture by faces was measured using event-related potential responses to faces and objects. We also examined behavioral attention capture by faces and objects using a habituation paradigm.
Results: In Experiment 1, greater sensory hypersensitivities (lower scores) at 2 years in toddlers with ASD (n=48) predicted larger amplitude ERP responses to faces (P1, P400 and Nc) at 4-years (Fig 1), and this in turn was related to greater social approach (interest and interaction). In Experiment 2, greater perceptual sensitivity at 6 months predicted larger P1 amplitude to faces at 18 months in infants at low (n=45) and high (n=43) familial risk for ASD.
Conclusions: In this study, we provide the first demonstration that early sensory sensitivities predict greater attention capture by faces, and this mediates improved social approach behaviors in the early development of ASD. Our findings are consistent with a theoretical model in which early hypersensitivities are associated with increased attention capture by stimuli with salient sensory features; and that because people tend to have salient sensory features in naturalistic environments (e.g. motion, audiovisual synchrony and unpredictability) attention capture to faces becomes stronger. In the context of a supportive environment, heightened sensory hypersensitivity may support social development for children with ASD. This information may be critical to consider when designing therapeutic strategies or trying to predict individual outcomes for children with ASD.

Poster Session
106 - Animal Models
12:00 PM - 1:40 PM - Golden Gate Ballroom

1 **106.001** A TrkB Partial Agonist Rescues Autistic-like Behaviors in Adult Mice Prenatally Exposed to Valproic Acid

M. Fahnestock[1], *C. Nicolini*[1], *V. Aksenov*[2], *E. Rosa*[1], *B. Michalski*[1], *C. D. Rollo*[2], *J. A. Foster*[1] *and F. M. Longo*[3], *(1)Psychiatry & Behavioural Neurosciences, McMaster University, Hamilton, ON, Canada, (2)Biology, McMaster University, Hamilton, ON, Canada, (3)Neurology and Neurological Sciences, Stanford University, Stanford, CA*

Background: The molecular mechanisms underlying autistic behavior remain to be elucidated. We previously demonstrated reduced TrkB and Akt protein expression in postmortem fusiform gyrus tissue from human idiopathic autism. Similarly, total and phosphorylated Akt protein are decreased in cortical tissue from rats prenatally exposed to valproic acid (VPA), a well-established model of environmental/epigenetic origins of autism. These findings implicate defective TrkB signaling through Akt as a molecular substrate of autistic behavior and a potential therapeutic target for autism.
Objectives: We examined whether increasing Akt signaling using the TrkB partial agonist LM22A-4 would restore Akt deficits and ameliorate autistic-like behavior in adult mice prenatally exposed to VPA.
Methods: Pregnant females received a single intraperitoneal (i.p.) injection of 500 mg/kg VPA on gestational day 12.5, while controls were injected with saline. Pups were weaned on postnatal day (PD) 21 and received an i.p. injection of either saline or LM22A-4 dissolved in saline (0.05 mg/g) once daily from PDs 21-35. Sociability and repetitive digging were evaluated on PDs 29-34 using the three-chambered social approach task and marble-burying test, respectively. Litters were killed and brain tissue harvested on PD 35. Akt protein and phosphorylation levels were measured by Western blotting in temporal/parietal neocortex.
Results: Adult mice prenatally exposed to VPA lacked sociability, exhibited increased repetitive digging behavior and had decreased cortical phosphorylated Akt. We demonstrated that treatment of prenatally VPA-exposed, adult mice with LM22A-4 restored sociability and decreased repetitive behavior. Additionally, LM22A-4 treatment together with enrichment from behavioral testing normalized cortical Akt phosphorylation.
Conclusions: Our results show that the TrkB partial agonist LM22A-4 rescues autistic-like behaviors in adult mice prenatally exposed to valproic acid, supporting the hypothesis that reduced Akt signaling contributes to autistic behavior, and that LM22A-4 has potential for treating sociability and repetitive/perseverative behavior in idiopathic autism.

2 **106.002** Alteration in EEG and Auditory Evoked Potential in a Mouse Model of Tuberous Sclerosis Complex

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Background:
Tuberous sclerosis complex (TSC) is a rare genetic disorder associated with autism spectrum disorder (ASD) in approximately 50% of cases, making it one of the most common genetic forms of autism. Dysregulation of the mTOR pathway in TSC results in alterations in axon outgrowth and synapse formation similar to many other autism related mutations. TSC, therefore, can be used as a model of autism related synaptopathy. The consequences of synaptopathy can be explored at the systems level through the measurement of neural activity via electroencephalography (EEG). Spectral power and evoked potentials measured from EEG can be used to quantify neural activity in both patients with TSC and in mouse models of *Tsc*mutation. Altered patterns of neural activity could be used as a translational, quantitative biomarker for the development of novel therapeutics.
Objectives:
To characterize auditory evoked potential and resting state EEG in a transgenic mouse model of TSC for use as a translational biomarker of synaptic function.
Methods:
Neural activity was measured using a wireless, telemeterized EEG recording system from mice expressing a hypomorphic *Tsc2*allele under control of a neuronal specific promoter. Electrical activity was recorded from a screw located over the frontal lobe. Spectral power from resting state EEG and auditory evoked potential elicited from a mismatch negativity paradigm were collected.
Results:
Mice with reduced expression of *Tsc2*have a reduction in oscillatory power in low frequency bands (theta) but an increase in power in the high frequency bands (beta and gamma). Mutant animals also have an alteration in the evoked response to auditory tones relative to control animals.
Conclusions:
The resting state and evoked changes in neural activity in the *Tsc2* mutant mouse could be used as a biomarker of alterations in brain connectivity underlying behavioral impairments. Comparison of the effect of pharmacological treatments on behavioral and neurophysiological measures in rodents and patients could enable the use of EEG as a translational biomarker of treatment efficacy.

3 **106.003** An Autism Mouse Model Exhibits Limbic System Alterations That Enhance Susceptibility to Stress

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Background:
Autism Spectrum Disorder (ASD) is characterized by abnormalities in social interaction and restricted/repetitive behaviors. *Engrailed-2 (En2)*, a gene associated with ASD, is a neural patterning transcription factor involved in the development of the embryonic mid-hindbrain region, where norepinephrine (NE) producing neurons emerge. Previous studies indicate that *En2* knockout (*En2*-KO) mice display ASD-like deficits in social interactions, and show depressive phenotypes behaviorally (forced swim) and physiologically (decreased cell number in the dentate gyrus and decreased neurons produced in adult neurogenesis), which implicate abnormal stress responses. Environmental stressors elicit physiological responses by increasing Hypothalamic-Pituitary-Adrenal (HPA) axis activity, which initiates in the paraventricular nucleus of the hypothalamus (PVN). HPA axis activation, specifically PVN activity, is modulated by projections from limbic structures, including the amygdala (stimulatory) and the ventral hippocampus (VH) (inhibitory). While dorsal forebrain structures in the *En2-KO* exhibit reduced NE levels and fiber innervation, innervation patterns into the ventral limbic system, including amygdala and PVN, are undefined.
Objectives:
Characterize NE fiber innervation into the basolateral amygdala (BLA) and PVN using biochemical and anatomical approaches, and determine whether neural activity, indicated by c-Fos immunohistochemistry, PVN, and VH following swim-stress correlates with NE innervation.
Methods:
In postnatal day 60-70 wild type (WT) and KO mice (N=4-6/genotype), western blot analysis was performed to determine protein levels of norepinephrine transporter (NET) and tyrosine hydroxylase (TH). NET-containing fibers in BLA and PVN were assessed on tissue sections using immunohistochemistry. To measure stress response, animals were given 10 minutes of swim stress followed by PFA fixation via cardiac perfusion at 120 to 140 minutes. Brain sections were cut at 40 µm, and stained for c-fos using DAB. All forced swim was performed between 12:00 to 2:00 PM EST.
Results:
En2-KO mice exhibited increased NET (1.7-fold, $p<0.02$) and TH (1.5-fold, $p<0.002$) protein levels in the amygdala. NET fiber counts were also increased in BLA (2.3-fold, $p<0.0007$) and PVN (1.7-fold, $p<0.016$). Following swim stress, *En2*-KO mice exhibited a 6-fold increase in c-fos nuclei in the locus coeruleus (the origin of NE fibers) compared to unstressed KO mice, while WT exhibited a 2-fold increase compared to unstressed WT. Further, the KO stress group also had a ~2-fold increase in c-fos signal in the PVN compared to the WT stress. Conversely, the En2-KO ventral hippocampus exhibited a blunted response to stress, where the increase in c-fos levels were approximately a quarter of those exhibited in the WT.
Conclusions:
Our observations indicate that NE fiber innervation in the *En2*-KO mice is markedly increased in the PVN and BLA, whereas it is reduced in the hippocampus. In turn, this pattern of enhanced excitatory signaling accompanied by reduced inhibitory activity will likely lead to excessive activation of the HPA axis, an outcome under current investigation.

4 **106.004** Analysis of Phenotypes in Rodent Models Based on High-Risk ASD Genetic and Environmental Factors

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Background: Â With identification of risk genes associated with autism spectrum disorder (ASD), rodent models provide access to the unique and common phenotypic outcomes for their perturbations. Increasing evidence also presents strong corroboration towards the involvement of environmental factors, such as maternal immune activation (MIA) during fetal development, as a risk factor for development of ASD. Again, rodent models have been successfully used to provide insights into the regulators of perturbation to pivotal pathways in the developing fetus in MIA, e.g., the role of proinflammatory cytokines, like IL-6 and IL-17a. However, given the heterogeneity of ASD features in the human population, as well as the relatively tenuous parallels between face validity in animal models and human behavior in the manifestation of the complex, multifactorial, neurodevelopmental disorders like ASD—i.e., in social behavior, communication and repetitive behavior—we look into the phenotypic characteristics of animal models based on strong genetic or environmental risk factors of ASD.
Objectives: Â Our aim is to assess the face validity of the entire set of models developed for genetic and environmental factors associated with ASD based on multiple lines of evidence. We examine the underlying causes in this set, something that has not been dealt in a detailed manner to the best of our knowledge.
Methods: Â Using the data in the Animal Module of AutDB (also known as SFARI Gene), we look into the detailed phenotypic data on the models based on high-confidence and strong-candidate genesÂ to uncover similarities in complex behaviors as well as in possible underlying neurophysiological or neuroanatomical substrates. Additionally, we also correlate the phenotypic outcomes seen in high-risk genes to those of maternal immune activation in various rodent models using several immune activators: influenza virus infection, viral infection mimicry using polyinosinic–polycytidylic acidÂ (poly(I:C)), bacterial infection, its mimicry using lipopolysaccharide (LPS) and modulation of cytokine levels. Our analysis looks into changes in phenotypes beginning during embryonic development to identify any common anomalies seen in brain development, followed by distinctive patterns in neuroanatomy and neurophysiology, by age: early postnatal, juvenile stages, through adulthood.
Results: Loss of function of high-confidence genes in mice causes increased embryonic lethality, which is not surprising as it is likely that these genes perform important developmental roles that have not been highlighted previously. Data from heterozygous and intricate conditional knockout mice of high-risk genes confirm that mouse models do recapitulate ASD features, reliably preserving face validity. From the data on genetic models combined with MIA models, there is some indication of common underlying changes in brain structure and function that are related to the observed impairments in social and repetitive behavior, even if deficiencies in communication are not that saliently reflected in these models.
Conclusions: Our analysis provides support for looking at large datasets of rodent models showing face validity of some features of ASD in order to elucidate common underlying mechanisms. We believe that, while striking observations are noted by studies conducted on one or two important ASD genes, a combined approach can bring out similarities not otherwise highlighted.

5 **106.005** Autism-Relevant Anatomic Changes in Brain Structure in the Antigen-Driven Animal Model of Maternal Autoantibody Related Autism

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Background: Numerous researchers have described the presence of maternal autoantibodies reactive to fetal brain proteins in a subset of mothers of children with autism spectrum disorder (ASD). Our lab identified 7 protein antigens for maternal autoantibody related (MAR) risk for ASD, and recently have mapped the antigenic epitope sequences recognized by these ASD-specific maternal autoantibodies. Our lab has now created an antigen-driven mouse model of MAR risk for ASD (MAR-ASD) in which autoantibodies reactive to the salient epitope sequences are generated in female dams prior to breeding, thus allowing for the continual exposure to the salient autoantibodies throughout gestation. Prenatally exposed offspring display robust deficits in social interactions and increased repetitive self-grooming behaviors as juveniles and adults during dyadic social interactions, demonstrating for the first time that these maternal autoantibodies are directly responsible for alterations in behaviors highly relevant to ASD. Furthermore, an association between maternal autoantibodies and alterations in neuronal development, including increased brain volume, has been demonstrated in previous passive transfer models as well as in the clinical population.
Objectives: The present study was designed to characterize the neuroanatomical differences in our clinically relevant antigen-driven mouse model of MAR risk of ASD using high-resolution structural MRI.
Methods: In order to generate epitope-specific autoantibodies that mimic those found in the mothers of children with ASD, C57BL/6J females randomly assigned to MAR-ASD treatment received a series of immunizations prior to breeding containing peptide epitope sequences of the four primary target proteins of MAR ASD (lactate dehydrogenase A and B, collapsin response mediator protein 1, and stress-induced phosphoprotein 1) conjugated via Multiple Antigenetic Peptide system technologies in addition to adjuvant. Control C57BL/6J females were injected with saline only. Following confirmation of autoantibody production in immunized animals by ELISA, females were then paired with male breeders to produce the experimental offspring of interest. Neuroanatomical differences in subsequent male and female offspring were assessed via high-resolution structural MRI at approximately 6 months of age (MAR-ASD = 22; Control = 23).
Results: In comparing MAR-ASD to WT adult brains, 31 of the 159 regions examined were found to be significantly different at an FDR of <5%. MAR-ASD offspring had significant increases in size of several white matter tracts, including the anterior commissure (pars anterior: +2.42%, FDR=4%; pars posterior: +3.89%, FDR=2%), cingulum (+2.52%, FDR=3%), corpus callosum (+3.19%, FDR=1%), and internal capsule (+2.67%, FDR=4%). Outside of the white matter, increases were observed in several cortical regions and in basal nuclei structures (nucleus accumbens: +2.68, FDR=2%; olfactory tubercle: +2.65%, FDR=2%; basal forebrain: +1.90%, FDR = 3%).
Conclusions: Our results suggest that numerous brain regions were significantly increased in offspring prenatally exposed to the salient maternal autoantibodies relative to controls. These findings further support the pathological role of maternal autoantibodies in ASD, with neuroanatomical alterations lasting into adulthood.

6 **106.006** Behavior Phenotyping of a Mouse Model of Phelan Mcdermid Syndrome with a Full Deletion of Shank3 Gene

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Background: Phelan-McDermid Syndrome (PMS) is a rare genetic syndrome in which one copy of the q13 portion of chromosome 22 is missing or mutated leading to a global developmental delay, hypotonia, delayed or absent speech, intellectual disability, and autistic behaviors. SHANK3, a gene coding for a key structural part of the post-synaptic density, is the critical gene for the core neurological and behavioral symptoms in this syndrome, and the loss of one copy of SHANK3, occurring through intragenic deletion or point mutation, is sufficient to cause Phelan-McDermid syndrome. However, the size of the region affected can be highly variable, from point mutation to up to 8 Mb deletions and the deletion size seems to be correlated with the syndrome severity. Due to multiple intragenic promoters and alternatively spliced coding exons within the gene, several Shank3 isoforms have been identified in human and mouse brains.
Objectives: Numerous mouse models have been generated but most target only some of those isoforms while the vast majority of SHANK3 mutations found in PMS patients are deletions of the entire gene. Our aim is based on a novel mouse model, in which all Shank3 isoforms are disrupted and which more closely mirrors the most common genetic mutations found in PMS and our goal was to investigate the behavioral consequences of a disruption of all isoforms of Shank3.
Methods: Our laboratory had previously created a mouse model with a deletion of exons 4 to 9 leading to the disruption of the full length Shank3 protein. We used a Cre-LoxP strategy to add an additional LoxP site flanking exon 22 and disrupt all isoforms. We carried an extensive behavioral phenotyping of neonate, young and adult wild-type, heterozygote and homozygote mice with a battery of test designed to assess the main feature of PMS including neurodevelopmental milestones, sensory and motor functions, sociability, stereotypies and cognitive functioning.
Results: Mice with a full deletion of Shank3 are more severely affected than our previously published mouse model with a partial deletion of Shank3.
Abnormal Mendelian ratios at the time of weaning were observed showing a significant deficit for homozygote mice that can be partially explained by an increase of early postnatal lethality. Both sensory and motor disabilities were detected in neonate and adult mice. While social performances and interest for social stimuli were not impaired, the homozygote mice displayed a strong object avoidance and escape behavior in several tests. Additionally, we observed a deficit in both initial training and reversal of Barnes maze, a spatial memory task involving hippocampal-prefrontal circuits. Electrophysiological recording showed that both hippocampal long-term potentiation and long term depression are impaired in heterozygote and homozygote animals.
Conclusions: Our new mouse model of PMS recapitulates the core symptoms of PMS providing an improvement of both construction and face validity compared to previous model. Ongoing experiments will allow to identify neural mechanisms and brain circuitry involved in PMS and will use this model to screen potential treatments for *Shank3*-haploinsufficiency.

7 **106.007** Behavioral Characterization of SLIT3 Knock-out Mice: SLIT3 Implications in ASD

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Background: Altered neuronal connectivity is a potential neural signature of Autism Spectrum Disorder (ASD). Slit/Robo signaling plays an important role in axon guidance, cell migration and dendritic spine formation, which is involved in the development of neuronal connectivity and structure. Indeed, Slit/Robo signaling has been implicated in the pathophysiology of ASD, as altered expression level of Slits or Robo receptors is observed in some individuals with autism. Furthermore, a genetic variant of SLIT3, one of genes encoding Slits, was found in individuals with ASD. Nevertheless, a direct relationship between SLIT3 mutation and autism associated behaviors has not been examined.
Objectives: The purpose of the current study is to investigate how SLIT3 mutation affects a variety of behavioral domains associated with autism in mice.
Methods: In order to characterize behavioral changes resulting from SLIT3 mutation, we examined two to four month old male and female SLIT3 knockout (KO) mice for locomotive, emotional, social, and cognitive behaviors using the open field, three chamber social, and novel object recognition tests.
Results: SLIT3 KO mice were observed to travel significantly shorter distances than WT mice in the open field test. In addition, female KO mice tended to spend shorter time in the center area of the open field when compared to the respective controls. Interestingly, KO mice were not different from the controls in social approach behavior and object recognition memory tests.
Conclusions: The reduced activity of SLIT3 KO mice in the open field test indicates that the KO mice are hypo-locomotive. The heightened tendency to avoid center area of the open field shown only in the female KO mice suggests that the deletion of SLIT3 induces a sex-specific anxiety. These findings suggest that SLIT3 may be involved in the formation of neural circuits that regulate locomotion and anxiety rather than social or cognitive behaviors.

8 **106.008** CADM1 Mutation Knock-in Mice As Mice Model of ASD Showing Abnormal Excitatory-Inhibitory Synaptic Balance

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Background: Previously, we detected two missense mutations (Y251S, H246N) on *Cell adhesion molecule1* (*CADM1*) in autism spectrum disorder (ASD) patients. *CADM1* is expressed in the membrane of both presynaptic and postsynaptic neurons, and acts as synaptic adhesion protein. Although *Cadm1*-KO mice showed increased aggression and anxiety behavior, repetitive behavior was not observed. In primary mouse nerve cell culture induced each missense mutations of *CADM1*, inhibition of dendrites extension and aggregation of mutant proteins in the endoplasmic reticulum were observed. Endoplasmic reticulum (ER) stress is considered to be induced by the genetic mutation and caused neural dysfunction.
Objectives: We speculated the two mechanisms as Cadm1 pathogenicity; the loss of function and the gain of function caused by ER stress. To analyze these possibilities and contribution of CADM1 to ASD, we established *CADM1* (Y251S) knock-in (KI) mice and analyzed.
Methods: For behavior analysis, social recognition test, foot print test and stereotyped behavior were performed. Western blotting for α-tubulin, PSD-95, vGlut1 and GABBR2, and fluorescence immunohistochemistry for synaptophysin, vGlut1, vGAT, GABBR2 and calbindin were performed focused in the cerebellum.
Results: A) Behavior analysis: Preference index of heterozygotes and homozygotes of *Cadm1*(Y251S)-KI mice were significantly decreased. Both heterozygotes and homozygotes showed abnormal social behavior.Foot print test did not detected significant difference between three groups.*Cadm1* (Y251S) -KI mice showed repetitive jumping behavior considered to be stereotyped behavior. Frequency were, WT; 0% and 0% in male/female, Heterozygotes; 12.7% and 6.4%, Homozygotes: 4.3% and 0%. On randomly chosen ten mice observation for 2 hours, average numbers of jumping/min for each mouse were 0.08 in WT, 9.26 in heterozygotes and 0.98 in homozygotes.
B) Brain tissue analysis: In immunohistochemical staining of cerebellum, Synaptophysin, a marker for pre-synaptic vesicles, and vGlut1, an excitatory pre-synaptic marker, were not different between WT and homozygotes. vGAT, an inhibitory pre-synaptic marker and GABBR2, inhibitory post-synaptic marker were stained strongly in homozygotes. On Western blotting analysis, GABBR2 was also expressed strongly in homozygotes compared. Expression of vGlut1 and PSD95, a postsynaptic expression marker, were not different between WT and homozygotes.
Conclusions: In behavior analysis, social behavior was impaired in both heterozygotes and homozygotes of *Cadm1*(Y251S)-KI mice. Repetitive jumping in heterozygote male mice may reflect the higher frequency in male in ASD. Abnormal social behavior is common feature of Cadm1-KO and *Cadm1*(Y251S)-KI. However, characteristic stereotypic behavior of ASD patient was seen in *Cadm1*(Y251S) -KI mice but not in Cadm1 KO mice. *CADM1* mutation was suggested to act as a Gain of function in ASD pathogenesis. Synaptic balance was shifted to the inhibitory in *Cadm1* (Y251S)-KI mice. Addition to the report that inhibitory synapses were increased in KI mice that carries *Nlgn3* (R451C) mutation identified in ASD patient. Synaptic balance shifted toward inhibitory is considered to be common mechanism of ASD. From these results, ASD was considered to be caused not only loss of function of mutant protein but also Gain of function induced by mutant protein, and candidate of the mechanisms were ER stress and imbalance of synaptic function.

9 **106.009** CASPR2 Deficiency in Juvenile Rats Recapitulates the Broad Phenotypic Spectrum of CNTNAP2-Related Disorders

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Background: *CNTNAP2* mutations are associated with neurobehavioral and neuropsychiatric indications present in multiple conditions such as ASD, IDD, ADHD, schizophrenia and bipolar disorder. Mice completely lacking *Cntnap2* have been used to model behavioral impairments, but these findings may not fully delineate the consequences of heterozygous deficiency predominantly reported in humans. Studies of adult *Cntnap2* animals also raise the question of whether features would manifest earlier during a period that is relevant to disease onset in some *CNTNAP2*-related disorders.
Objectives: To evaluate the neurobehavioral and cellular deficits caused by the reduction or absence of CASPR2 in rats.
Methods: We profiled the neurobehavioral and cellular consequences of either haploinsufficiency or the complete loss of *Cntnap2* in juvenile rats, given that we recently reported that the consequences of ASD/IDD-related gene deficiency may differ among divergent rodent species. A battery of behavioral evaluations were conducted from postnatal day 24 to 39 using both male and female *Cntnap2*$^{+/-}$ and *Cntnap2*$^{-/-}$ rats. In addition, molecular studies were conducted to confirm the nature of the targeted allele, as well as to identify whether cellular abnormalities previously reported in *Cntnap2* mice were also present in this novel rat model.
Results: Juvenile *Cntnap2*$^{+/-}$ and *Cntnap2*$^{-/-}$ rats display obsessive-compulsive-like behaviors, increased play behavior, hyperactivity and an increased acoustic startle response. Impairments were dose-dependent in some cases. A limited number of behavioral impairments were altered as a function of both genotype and sex. Juvenile *Cntnap2*$^{-/-}$ rats also showed decreased cortical interneuron number but not abnormal neuronal migration, and behavioral seizures were apparent as early as seven weeks of life.
Conclusions: A reduction or complete absence of CASPR2 results in strikingly different behavioral outcomes in rats compared with mice; however obsessive-compulsive-like behaviors, hyperactivity and some neuropathological alterations are shared between the two species. Taken together, these findings provide insight into the consequences of CASPR2 deficiency in a complementary rodent model, and identify the common features among *Cntnap2* genetic tools that may serve as useful outcome measures for future preclinical studies.

10 **106.010** Cdh11 Deficient Mice Exhibit Autism-like Behavioral Abnormalities

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Background: Genome-wide association studies and whole exome sequencing have shown that genetic variants of type II cadherins are associated with autism. However whether there is a causal relationship between cadherin deficiency and autism traits at behavioral and pathological levels remains to be clarified. The cerebellum or its input/output structure is among the most consistently-reported areas of vulnerability in autism, as evidenced by cellular and functional pathology. Individuals with ASD exhibit deficits in motor control in addition to core autism symptoms such as difficulties in language and social interaction. Our preliminary results show extensive expression of cadherins in the cerebellum. However the role of cadherins in the development and function of cerebellar circuities is not well understood.
Objectives: The Cadherin-11 gene knockout (KO) mouse was used as a model system to elucidate the behavioral impact of cadherin deficiency and the underlying brain developmental mechanisms, with a focus on pathological changes in the cerebellum.
Methods: In-situ hybridization was used to reveal the expression of Cadherin-11 in developing brain. Immunofluorescence staining of sagittal and coronal brain sections was applied for histological analysis of the Cadherin-11 KO mouse. Standard open field test, elevated plus maze, and 3-chamber social preference test were carried out to evaluate autism-like behaviors. Gripping strength test, horizontal bar test, rotarod test, and footprint analysis were performed to evaluate the motor function of the animal.
Results: In the developing mouse brain, Cadherin-11 is expressed in structures that are known to be closely relevant to autism, including the cerebellum and in the inferior olivary nucleus, which projects to the cerebellum. Compared to wild type (WT) littermates, most Cadherin-11 KO mice showed reduced brain sizes, including the cerebral cortex and the cerebellum. In the cerebellum, the lobes failed to fold to the mature pattern. This developmental deficit appeared to occur postnatally as the brain sizes were largely unaffected when examined at E18.5. Both male and female Cadherin-11 mutant mice are hyperactive, as reflected by a significantly elevated time to explore the central area of the open field arena compared to WT littermates. In an elevated plus maze test, mutant mice spent significantly less time in the open arm, indicating elevated anxiety levels. Consistent with deficits in cerebellum-related motor coordination, mutant mice also exhibited significantly lower scores in the gripping strength test and horizontal bar test and showed abnormal gait pattern in foot print analysis. The 3-chamber social preference test, however, showed that Cadherin-11 mutant mice were not severely impaired in social interactions.
Conclusions: Cadherin-11 is required for the development of some specific brain functions which are altered in autism. Loss-of-function of a single autism risk gene, Cadherin-11, in mice is sufficient to generate several important aspects of the autism-like behavior abnormalities (hyperactivity, high anxiety, and motor deficits) potentially by affecting cerebellar function. Cadherin-11 gene knockout mice may serve as a novel animal model to further dissect the mechanisms of olivocerebellar circuit changes in autism.

11 **106.011** Cerebellar Networks Are Altered in Autism - Examined with Mouse Models

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Background: Over the past 7 years, we have established a large cohort of mouse models related to autism. This allows for investigation of a large autism population in the mouse, which can be also viewed as representative of idiopathic autism. Therefore, differences in networks or regions across autism can be determined. The cerebellum has been frequently found to be different in autism and autism related disorders (see reviews by Tsai, 2016, Hampson and Blatt 2015, and D'Mello and Stoodley 2015), so the question we asked was: Can we detect cerebellar differences across our model autistic population?
Objectives: To assess differences in the cerebellum and cerebellar networks across multiple autism mouse-lines to determine any commonalties or differences shared across the population.
Methods: The data used in this study was accumulated from 44 different autism mouse-lines and included greater than 60 genotypes and over 1500 mice.
MRI Acquisition – A multi-channel 7.0 Tesla MRI was used to acquire anatomical images of the brain. A T2-weighted, 3-D fast spin-echo sequence was used that yielded an image with 56 µm isotropic voxels (3D pixel) in ~14 h.
Data Analysis – To visualize and compare any differences the images are registered together. The goal of the registration is to model how the deformation fields relate to genotype, wild-type (WT) vs. autism mutant (Lerch et al., 2008). Volume differences are then calculated across the cerebellum in individual voxels or for 39 different cerebellar regions and their corresponding network (Dorr et al. 2008, Ullmann et al. 2013, and Steadman et al. 2014).
Results: Overall the cerebellum as a whole was one of the most affected regions across the brain (Ellegood et al. 2015), and for this work, was further divided into 4 different subgroups, in addition to the cerebellum as whole, we examined the cerebellar cortex, hemispheres, vermis, and deep cerebellar nuclei (DCN). Out of those five regions only the DCN, the outputs of the cerebellum, were significantly smaller in the autism group (t-value of -4.26). Therefore, we further examined the projections from the DCN using anatomical covariance to assess the structural connectivity (Evans, 2013). The connectivity was measured between the DCN and the cerebellar cortex, thalamus, pontine nucleus, and the cortex, and was found to be altered only between the DCN and cortex (Figure 1) in the autism models when compared to the WT
Conclusions: Using anatomical covariance to assess structural connectivity in the mouse models of autism has revealed an alteration in the connectivity between the DCN and the cortex. This alteration preferentially affects the somatosensory, visual and association corticies. Further investigation is warranted to determine the underlying cause of this difference.

12 **106.012** Cerebrospinal Fluid Arginine Vasopressin Is a Predictive Biomarker of Social Impairments in Male Rhesus Monkeys

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Background: Autism spectrum disorder (ASD) is characterized by core social impairments, but its basic biology remains poorly understood. Early and accurate diagnoses are difficult and there are no laboratory-based diagnostic tests to detect, nor medications that effectively treat, the social features of ASD. Scientific progress has been impeded by the difficulty of obtaining relevant tissue samples from patients and matched controls. In mouse models, while tissue is available, there is frequently discordance between complex human behavior and laboratory-based mouse behavior, even with shared genetic etiologies. These limitations underscore the tremendous value in developing a monkey model of social impairments with more reliable behavioral and biological homology to the human disease.
Objectives: Like humans, rhesus monkeys (*Macaca mulatta*) are highly social, and both species display stable and pronounced individual differences in social functioning. At the behavioral extremes, low-social compared to high-social male monkeys initiate fewer affiliative interactions and display more inappropriate social behavior, suggesting both lower social motivation and poorer social skills. The aim of this study was to develop a novel primate model using ethological observations to identify low-social male rhesus macaques and test whether they demonstrate abnormalities in key neuropeptide pathways [e.g., arginine-vasopressin (AVP) and oxytocin (OXT)], previously implicated in ASD.
Methods: Study subjects were male rhesus monkeys aged 1-5 years. In cohort 1, N=42 monkeys (selected from a pool of N=222) were identified on the basis of archived behavioral data thought to predict later low (N=21) or high (N=21) social functioning. Quantitative social behavior data and personality assessments were collected by blinded observers using established protocols. After completion of behavioral phenotyping, monkeys with the most extreme scores (N=15 low-social monkeys and N=15 high-social monkeys) were selected for biological sample collection. In a second, independent cohort, N=164 male monkeys were observed and social behavior observations obtained using a higher-throughput scan sampling-based method to identify a subset of N=25 low-social and N=25 high-social monkeys. Cerebrospinal fluid (CSF) and blood samples were concomitantly drawn on two separate occasions and later quantified for AVP and OXT concentrations using established enzyme immunoassays.
Results: Logistic regression showed that CSF AVP concentration (LR ChiSq=16.55; $p<0.0001$) robustly classified monkeys by social group. Using a general linear model, we found that low-social monkeys also had lower CSF AVP concentrations compared to high-social monkeys ($F_{1,18}=9.236$; $P=0.0071$). We then sought to replicate these findings in the second cohort. As before, CSF AVP concentration strongly predicted social classification (LR ChiSq=7.969; $p<0.0048$), with low-social monkeys showing lower CSF AVP concentrations compared to high-social monkeys ($F_{1,24}=8.847$; $P=0.0066$). CSF OXT concentrations did not differ by social group.
Conclusions: Although the majority of research has focused on OXT, rather than AVP, as a biomarker of social deficits in ASD, our findings suggest the provocative notion that the AVP signaling pathway may be a more promising therapeutic target by which to enhance social functioning in male primates.

13 **106.013** Cntnap2 -/- Autism Model Mice Display Deficits in Tonic and Phasic Inhibition in Primary Visual Cortex

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Background: Investigations into the genetics of individuals with autism suggest that mutations in genes involved in synaptic function are a common factor. Both human studies and animal models suggest that such synaptic dysfunction frequently leads to excitatory/inhibitory (E/I) imbalance in the form of reduced inhibition and/or over-excitation, and that neuronal inhibition may be impacted by both pre- and post-synaptic changes. *Cntnap2* -/- mice are a well-established model of ASD. A number of studies have found that these mice exhibit autism-like behaviors including reduced social interaction, hyperactivity, and repetitive/stereotyped behavior. In addition, *Cntnap2*-/- mice exhibit aberrant neuronal migration, reduced interneuron numbers, seizure activity, and alterations in synaptic spines.
Objectives: Due to reported decreases in PV+ interneurons in *Cntnap2* -/- mice, we hypothesized that loss of the neurexin family gene *Cntnap2*would result in reduced inhibition and increased excitation in pyramidal neurons in the visual cortex. We aimed to test multiple forms of inhibition and excitation including intrinsic membrane excitability and tonic inhibition, which is mediated by extrasynaptic GABA receptors and modulates neuronal excitability.
Methods: We used whole-cell patch clamp electrophysiology to examine membrane properties and tonic and phasic inhibition in L2/3 pyramidal cells of primary visual cortex (V1) of *Cntnap2* -/- and +/+ mice at two different time points, 3-4 weeks and 6-8 weeks of age. Tonic inhibitory currents were induced by application of 5 μM GABA or 10 μM THIP, in the presence of blockers of excitatory neurotransmission. $GABA_AR$ subunit protein levels were measured via western blot using tissue lysates prepared from area V1, with antibodies against the γ2 and δ subunits.
Results: We found that L2/3 pyramidal cells from 6-8 week old *Cntnap2* -/- mice exhibited significantly smaller GABA-induced inhibitory tonic conductance. Application of THIP, a specific activator of δ-subunit containing $GABA_ARs$, also induced a smaller tonic current in *Cntnap2* -/- mice compared to controls. In 3-4 week old mice we found no significant effect of genotype on tonic inhibition. We also analyzed sIPSCs in both genotypes and age groups. In 3-4 week old mice we found no differences in sIPSC amplitude, frequency, or kinetics, but did observe an age-dependent effect of genotype in 6-8 week old animals, with lower sIPSC frequency in *Cntnap2* -/- mice. We did not observe an effect of age or genotype on resting potential or intrinsic excitability of L2/3 pyramidal cells in area V1. Western blot analysis of $GABA_AR$ subunit protein levels also found reduced levels of the γ2 subunit, but not the δ subunit, in *Cntnap2*-/- mice.
Conclusions : Our findings indicate that network-level GABAergic function is disturbed in *Cntnap2* -/- mice in a manner dependent on $GABA_ARs$ containing the δ subunit. This result is consistent with previous reports of reduced interneuron numbers, altered network activity, seizure susceptibility, and reduced interneuron numbers in autism. Our data suggest that reduced tonic inhibition could underlie autism-like behaviors, and future studies should investigate cellular/molecular mechanisms of reduced tonic inhibition as well as the effects of diminished inhibition on cortical function *in vivo*.

14 **106.014** Development of Behavioral Assays to Assess ASD-like Behaviors in a Drosophila Model

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Background: Autism spectrum disorder (ASD) is a genetically diverse disorder characterized by social deficits and repetitive behaviors. Research has focused on molecular mechanisms and phenotypic consequences of ASD-associated genetic mutations using transgenic animal models. The fruit fly (*Drosophila melanogaster*) is beginning to be used to model genetic mutations associated with neurodevelopmental disorders, including ASD, due to its short gestation period and simple genome. Several assays exist to assess molecular mechanisms in drosophila. However, less work has focused on behavioral assays. The recent use of drosophila in the study of ASD necessitates the development of ASD-relevant behavioral assays in drosophila.
Objectives: We aim to (a) develop a set of behavioral assays and coding schemes to measure ASD-like behavior in drosophila, and (b) estimate reliability, stability, and sensitivity-to-change of the assays. These include assays for stereotyped motor behavior, activity level, and social interaction.
Methods: We used male, transgenic flies expressing either a healthy or mutated copy of the human dopamine transporter (DAT) gene to test our assays. This mutation is a recently discovered rare variant associated with ASD. For the stereotypy and activity assay, flies (9 healthy, 9 mutant) were tested individually in an enclosed arena that permitted locomotion but not flying. The fly's movements were recorded with a high-speed camera (1000 frames/second) during a baseline period and a challenge period. During the challenge period an ecologically relevant predatory wasp sound was presented to elicit stress-induced effects on locomotor and social behaviors. Trained observers coded the flies' behavior by segmenting the videos into 150ms intervals and assigning each interval a behavior code (locomotion, idle, or stereotypy). The social assay used the same arena and stimulus presentation; however, in this assay, 4 flies were present in the arena concurrently (24 healthy and 24 mutants in total). Distance to nearest neighbor preceding and following stimulus onset was used as a measure of social response to the predatory sound. Previous work in drosophila has demonstrated that a distancing response to stress is adaptive and socially relevant.
Results: Our assays indicated that rates of stereotypy were low for both groups and did not change in response to the stimulus. Idle behavior was higher in the mutants than in the healthy flies ($F = 6.43$, $p = .022$) but was not significantly affected by stimulus onset. Locomotion was lower in mutants than in healthy flies ($F = 8.32$, $p = .011$) and demonstrated a trend for a group by time interaction ($F = 3.09$, $p = .059$) suggesting altered locomotor response to stress in the mutants. The social assay indicated that at baseline, the groups did not differ in social distance. After stimulus onset, mutants remained closer together than healthy flies ($F = 6.57$, $p = .0297$) suggesting a failure of mutant flies to display a socially adaptive response.
Conclusions: Our assays were reliable and sensitive for detecting a variety of ASD-relevant behavioral endpoints. Future work is needed to refine these behavioral assays and examine their effectiveness in a larger variety of ASD-related genetic mutations.

15 **106.015** Developmental Control of Cortical Gabaergic Interneuron Number Via Pten Signaling

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Background: GABA is the main inhibitory neurotransmitter in the mammalian nervous system. Proper balance of excitation and inhibition is critical for the normal development of cognition, as evidenced by a range of neuropsychiatric disorders, including autism spectrum disorder (ASD), that feature dysregulation of this process. Cortical GABAergic interneurons (INs) are over-produced during early development, with a substantial fraction undergoing programmed cell death through an unknown mechanism during early postnatal life to arrive at a mature population size. *Pten* encodes a phosphatase that regulates cell death under normal and pathological conditions, and mutations in *PTEN* are a risk factor for ASD.
Objectives: In this study, we test the hypothesis that intrinsically determined cell death of developing cortical GABAergic INs occurs through a Pten-dependent mechanism.
Methods: We have generated mice in which a conditional heterozygous mutation in *Pten* is introduced into developing GABAergic cells. Our analysis of these mice has employed a variety of techniques, including immunohistochemistry, flow cytometry, cell culture and behavioral testing.
Results: We find that mutant animals fail to show the approximately 20% decrease in cortical GABAergic cells during early postnatal development that occurs in control animals. We also observe reduced markers of apoptosis in *Pten* mutant cortical GABAergic cells during development and we present evidence that Pten is both necessary and sufficient to induce the intrinsically determined cell death of this cell type. Mutant animals display increased seizure resistance, decreased social interaction, and altered cortical network activity as indicated by c-Fos, consistent with a net imbalance of excitation and inhibition.
Conclusions: Together, our findings indicate a role for Pten in the intrinsic regulation of cell death and population size in developing cortical GABAergic INs. These results have relevance for understanding abnormal scaling of IN number in the brains of individuals with ASD.

16 **106.016** Developmental and Juvenile Ultrasonic Vocalizations in the Shank3 Mutant Rat Model of Phelan-Mcdermid Syndrome and Autism Spectrum Disorder

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Background: Mutations in the *SHANK3* gene lead to autism spectrum disorder (ASD), Phelan-McDermid Syndrome (PMS), as well as intellectual disabilities (Betancur & Buxbaum, 2013; Gauthier et al., 2009; Leblond et al., 2014; Moessner et al., 2007). Reduced expression of *SHANK3*, which codes for a synaptic scaffolding protein, has been hypothesized to lead to impairments in key brain functions underlying social communication and cognition (Durand et al., 2007). Both mutant mouse and, more recently, rat models have been generated in an effort to assess the neurobiological and behavioral effects of mutations in *Shank3* (Yang et al., 2012; Peca et al., 2011; Kouser et al., 2013; Harony-Nicholas et al., 2015; Jaramillo et al., 2016; Zhou et al., 2016).
Objectives: The present experiments aimed to evaluate various aspects of social communication using the sophisticated tool of ultrasonic vocalizations, taking advantage of the only generated rat model of *Shank3* mutations and carrying out studies across early life and during critical juvenile developmental windows in both haploinsufficient and null mutant animals.
Methods: Isolation-induced ultrasonic vocalizations (USVs) were collected from newborn Sprague-Dawley rat pups on postnatal day (PND) 7, the peak day of calling (Wöhr et al., 2008). As juveniles (PND 26-29), a USV playback paradigm was executed by presenting individual rats with a natural 50-kHz USV versus an acoustic control stimulus, and comparing subsequent USV production and approach behavior toward the stimulus source. Juvenile sociability was also assessed via the three-chambered social approach assay in which rats could choose to interact with a novel object or a novel conspecific, a social novelty assay in which rats could choose to interact with a familiar or a novel conspecific, and a play-promoting reciprocal social interaction assay in which rats could freely engage with a novel wildtype (WT), sex-matched conspecific.
Results: Male *Shank3* heterozygous pups exhibited reduced USVs, emitting significantly fewer calls compared to male *Shank3* WT pups. The USV playback assay revealed no genotype differences in locomotor response, as rats of all genotypes and sexes similarly approached the source of the 50-kHz USV and spent more time in close proximity to the source of the affiliative 50-kHz call than the control stimulus. Effects of genotype on USV emission during the playback assay are currently being analyzed. Preliminary data suggest normal sociability during the social approach assay but deficits in the preference for social novelty, as well as subtle genotype effects on some measures of the reciprocal social interaction assay. We are continuing the data analysis and reproducibility experiments at this time.
Conclusions: This study led to the discovery of a novel phenotype, reduced pup call emissions, in the *Shank3* rat model of PMS and ASD. The data presented here lend support for the important role of *Shank3* in social communication and for the use of this rat model as a tool to study the neurobiology underlying the behavioral phenotypes of PMS and ASD. These findings will provide the basis for further investigations into both the behavioral and biological consequences of mutations in *SHANK3*.

17 **106.017** Efficacy of a Multimodal Versus a Selective Serotonin Reuptake Inhibitor to Enhance Sociability and Reduce Marble Burying in BTBR Mice

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Background: Impaired social behavior is the most drug treatment-resistant core autism symptom. Selective serotonin reuptake inhibitors (SSRIs, such as fluoxetine or Prozac) block serotonin (5-HT) clearance from brain extracellular fluid by the serotonin transporter (SERT). SSRIs enhance social behavior for some autism patients and in socially deficient BTBRT+Itpr3tf/J (BTBR) mice, but generally they fail to aid the majority of patients with autism. The 5-HT_{1A} receptor partial agonist, buspirone (2 mg/kg) enhanced BTBR sociability just as well as Prozac (10 mg/kg) did. This finding led us to hypothesize that a multimodal SSRI such as vortioxetine might better enhance social and reduce restrictive repetitive behaviors via combined pharmacological targeting of SERT and 5-HT_{1A} receptors.
Objectives: Vortioxetine inhibits SERT, and is a 5-HT_{1A} agonist, among other actions. We sought to compare the efficacy of vortioxetine versus an SSRI to enhance sociability and reduce marble burying in mice. Occupancy of 5-HT_{1A} receptors by vortioxetine in behavior-tested mice was subsequently measured. Since the hormones oxytocin and corticosterone can shape behaviors and 5-HT_{1A} governs their release, their levels in vortioxetine and vehicle treated groups were compared.
Methods: Adult male BTBR mice were used to examine the effects of blocking SERT with the highly specific SSRI citalopram versus vortioxetine, a multimodal antidepressant, at a range of doses on social preferences and on repetitive burying. Vortioxetine (5 or 10 mg/kg) or citalopram (0.5, 5, or 50 mg/kg) were administered by i.p. injection 30, 60 or 120 min before sociability tests, and 75, 105 or 165 min before marble burying tests. [^{3}H] escitalopram was used to assess SERT occupancy, while [^{3}H] WAY-100635 was used for 5-HT_{1A} receptor occupancy by ex vivo autoradiography. Serum hormone levels were measured using enzyme-linked immunoassay kits and a microplate reader.
Results: In social interaction preference tests, vortioxetine (10 mg/kg) administered 30 min before testing enhanced social sniffing ($p<0.05$) relative to vehicle controls, in contrast to citalopram, which lacked efficacy to do so at all doses. However, the sociability enhancing effect of vortioxetine was lost if administered 60 -120 min before testing. Vortioxetine (10 mg/kg) and citalopram (50 mg/kg) significantly reduced marble burying ($p<0.02$) at all post-administration times measured. At 110 min after administration, 10 mg/kg vortioxetine achieved occupancies (%) of 84 ± 1, 31± 12 and 80 ± 5 of SERT, 5-HT_{1A} and also 5-HT_{1B}receptors in various brain regions with relatively high ligand binding densities. Oxytocin levels were slightly elevated ($p <0.05$) in vortioxetine and citalopram treated mice. Corticosterone levels did not significantly differ among treatment groups following the behavior tests.
Conclusions: Overall, these findings indicate that both vortioxetine and citalopram have greater potential to suppress restrictive-repetitive behaviors than to enhance sociability, at least in BTBR mice. Only vortioxetine enhanced social sniffing, albeit transiently.Â Further investigation of vortioxetine as a potential treatment for core autism symptoms in other mouse models would help to establish itsÂ potential as a therapeutic to ameliorate core autism symptoms.Â Vortioxetine's properties at other 5-HT receptor subtype targets might have also contributed to these effects.

18 **106.018** Fronto-Striatal Anatomy, Dependent-Behavior, and Neuronal Activity in a Rat Model of Fragile X Syndrome

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Background: Fragile X Syndrome (FXS) is a neurodevelopmental disorder that is considered to be a leading known monogenic cause of autism spectrum disorder and the most common form of inherited mental retardation. FXS is caused by reduced expression in the Fragile X Mental Retardation Protein (FMRP), which is encoded by the *FMR1* gene. Patients are left with anatomical abnormalities in their fronto-striatal network, deficits in attention and executive function, which are fronto-striatal-dependent behaviors, and dysfunctional recruitment of this network in an attentional task. Currently no pharmacological treatment for FXS is on the market. There are few robust and replicated morphological, physiological, and behavioral findings from the *Fmr1*-KO mouse model of FXS, however, therapeutics that successfully reversed negative symptoms in these mice have so far failed to prove efficacy in clinical studies. Potential therapies are more reliable if their therapeutic effects can be replicated in two species before being progressed to clinical trials. Therefore, the field would benefit from a viable rat model. Rats have a more developed prefrontal cortex (PFC), are faster at acquiring complex cognitive tasks that require the PFC, and have larger brains, which facilitate the study of morphology and behavioral electrophysiology.
Objectives: Studies on the *Fmr1*-KO rat have the potential to extend observations from existing mouse models on the role of Fmrp in the function of a PFC-related network and provide a better platform for development and evaluation of potential therapeutic strategies. Furthermore, since Fmrp is expressed throughout the brain and a loss of Fmrp may differentially affect brain regions, it is important to study circuits such as the fronto-striatal circuit. This study will aim to test whether insufficiency of Fmrp will cause disruption to the fronto-striatal cognitive network and lead to deficits in its morphology, activity, and dependent behaviors.
Methods: To test the effects of Fmrp loss on fronto-striatal circuit anatomy, this study will compare the regional volumes, dependent behaviors, and electrophysiological function of this circuit between *Fmr1*-KO rats and wild type (WT) littermates. Volumetric analyses will be conducted using Magnetic Resonance Imaging (MRI). The five-choice serial reaction time task (5-CSRTT), which tests the ability to correctly identify which of five ports has been briefly illuminated, will be used to test attention. Neuronal activity will be examined by recording local field potentials (LFP) of fronto-striatal regions, the PFC, anterior cingulate cortex, and nucleus accumbens, during the behavioral task.
Results: MRI data has been collected and analysis of these images using a pipeline, which performs automated nonbiased brain segmentation, is underway. *Fmr1*-KO rats display attentional deficits during training on the 5-CSRTT, as evidenced by preliminary data, which show a decrease in accuracy and an increase in omission rate (Figure 1). These deficits suggest that fronto-striatal-associated cognitive behavior is impaired in Fmrp-deficient rats. We are beginning to record LFPs during the 5-CSRTT.
Conclusions: This multi-level approach will allow for a better understanding of neural mechanisms affected in FXS, with the potential of discovering a new type of treatment target and providing an output measure for screening of potential therapies.

19 **106.019** Functionalization of ASD Variants of PTEN in C. Elegans

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Background: This study is part of a multi-model platform to functionalize Autism Spectrum Disorder (ASD) gene variants. A primary challenge in studying genes associated with ASD is the lack of an in vivo system in which to rapidly and cost-effectively functionally validate and characterize the large number of candidate risk genes. The sheer number of mutations associated with ASD and the time and money constraints associated with modeling ASD in mammals necessitates an alternative approach.
Objectives: Use the high throughput capacity of Caenorhabditis elegans as an in vivo platform to functionally validate and characterize ASD-associated genes and their variants.
Methods: We have identified a list of high confidence ASD-associated gene variants by combining evidence from >20 exome and whole genome sequence reports. Here, we use our machine vision system, the Multi-Worm Tracker, to characterize morphology, locomotion, and habituation phenotypes of 99 strains of C. elegans covering 87 ASD-associated gene orthologs. In parallel, we have created transgenic C. elegans each expressing a different ASD-associated de novo missense mutation in PTEN in order to validate and assess the functional affects of these putatively pathogenic amino acid substitutions in vivo.
Results: This research has generated a large number of novel genotype to phenotype relationships that range from severe developmental delays and uncoordinated movement to subtle deficits in sensory and learning behaviours, as well as detailed structure-function information indicating which ASD-associated PTEN variants are strong function altering mutations.
Conclusions: This data will be a powerful in vivo tool to identify missense mutations in ASD-associated genes that impact protein function and induce dysfunction in a well characterized neural system assay. Findings will inform future targeted in vivo studies in higher organisms and holds the potential of identifying novel therapeutic targets for ameliorating the effects of ASD.

20 **106.020** Functionalization of ASD Variants of PTEN in Rat and Xenopus

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Background: This study is part of a multi-model platform to functionalize Autism Spectrum Disorder (ASD) gene variants. One of the major challenges to understanding the mechanistic causes of ASD is the high, and ever growing, number of associated genes. To date the research community's approach of focusing on one gene at a time using a limited set of very low-throughput assays has yielded potential cellular phenotypes for only a handful of genes. The complexity of this problem is confounded by the identification of multiple mutations of the same ASD-associated genes, culminating in many thousands of gene variants currently without functional phenotyping. A radically different approach is required in order to make significant headway in the near future.
Objectives: We have developed a multiple-platform approach combining high-throughput and high-resolution assays to test large numbers of ASD-associated genes and their multiple variants inÂ *Saccharomyces*,Â *Drosophila*,Â *C. elegans*, *Xenopus*, and mammalian hippocampal culture model systems. We focused on the ASD-associated gene PTEN (phosphatase and tensin homolog), a crucial negative regulator of the PI3K/mTOR pathway. In this presentation we discuss the impact of PTEN variants identified as altering PTEN function in high-throughput assays on the morphological growth and synaptogenesis of rat primary hippocampal neurons and newly differentiated neurons within the intact developing brain of Xenopus tadpoles.
Methods: We have expressed PTEN variants in primary neuron cultures with a PTEN knockdown background and describe effects on neuron morphology, synapse number and balance. Using in vivo time-lapse two-photon imaging in awake, transparent *Xenopus laevis* tadpoles, we report the effects of PTEN variants expressed by single-cell electroportation on the dendritic arbor growth of developing brain neurons.
Results: Rat hippocampal neurons overexpressing human WT PTEN demonstrate a decrease in spines and PSD95 puncta compared to controls, which is not observed in neurons overexpressing the loss-of-function variants. RNAi knockdown of PTEN increased spine number, PSD95 puncta and soma size. These phenotypes were not rescued by expressing loss-of-function human PTEN variants associated with ASD. In Xenopus, expression of ASD-associated variants induced abnormal dendritic arbor growth phenotypes in vivo.
Conclusions: Our high-resolution assays of neuronal morphogenesis and synaptogenesis provide insight into the underlying pathophysiology and neural circuit development abnormalities that may give rise to ASD.

21 **106.021** Functionalization of ASD Variants of PTEN in Yeast and Fly

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Background: This study is part of a multi-model platform to functionalize Autism Spectrum Disorder (ASD) gene variants. Through whole-exome sequencing efforts, dozens of genes have been identified as strong candidate ASD risk genes. Multiple likely loss-of-function variants have been identified in all of these genes. The research community is now faced with the daunting task of determining how multiple genes may contribute to ASD. Although several bioinformatic tools exist to predict pathogenicity, it is uncertain how accurate these predictions are and impossible to understand the phenotype of each variant through these assays.
Objectives: To address this problem, a two-stage strategy was used to capitalize on high-throughput biological systems to screen for gene mutations most likely to provide strong phenotypes that are then forwarded to secondary, slower throughput but higher resolution assays. The first gene chosen to be studied in this paradigm was PTEN (phosphatase and tensin homolog) which is a crucial negative regulator of the PI3K/mTOR pathway.
Methods: Wildtype, human PTEN and its multiple variants, selected based on bioinformatics assessment of association with ASD or expression in the normal population, were expressed in high-throughput assays in yeast and Drosophila. In yeast, Synthetic Genetic Array (SGA) technology was used to screen ~5,000 yeast strains to identify deletion mutants that were sensitive to overexpression of wild type human PTEN. Strains identified through the yeast SGA with wildtype PTEN were then used to assay the activity of over one hundred PTEN variants. Using GAL4-mediated human gene/variant expression in Drosophila, we identify gain of function phenotypes and variants of altered function. Combined with assays for protein stability in both yeast and Drosophila, these experiments gave quantitative information on variants that likely result in loss of PTEN function in vivo.
Results: From the original SGA screen, a small subset of yeast deletion strains were identified as having genetic interactions with wildtype PTEN. Through the creation of a 'mini array' containing these deletion strains, it was possible to determine an interaction profile for each of the over one hundred PTEN variants selected for study. The results from this screen were then compared to the stability data to identify PTEN variants with varying stability and interaction states as compared to wildtype.
Conclusions: Through these assays we were able to classify PTEN variants based on their protein stability, genetic interactions interactions, and effects on nervous system function in an in vivo model. ASD-associated PTEN variants fell into distinct classes based on these measures. Results guided selection of variants for high-resolution assays.

22 **106.022** Integrity and Functionality of the Hypothalamic Oxytocin System and the Effect of Oxytocin Treatment in Two Rat Models for Autism

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Background: Social behavior deficits are a core symptom in autism spectrum disorder (ASD), which up to date have no pharmacological treatment. The hypothalamic oxytocin (OXT) system is a well-known modulator of social behavior, which brought interest in using the OXT peptide to treat social behavioral deficits. Our studies in a rat model for ASD, the *Shank3*-deficient rat, demonstrated that intracerebroventricular (I.C.V) OXT administration ameliorates attentional and social memory deficits. Clinical trials of OXT in ASD produced equivocal results raising questions about (1) whether this equivocally is driven by the heterogeneity in ASD, where some ASD subgroups may benefit better than others and (2) if the efficacy of OT treatment is dependent on the functionality of the OXT system and/or is sensitive to specific developmental window. Addressing these questions is challenging due to the lack of predictive biomarkers to identity relevant subgroups that might be most helped by OXT, and the lack of sufficient and diverse postmortem samples to determine how OXT-system is affected in different ASD subjects. Genetic animal models with mutations in ASD-associated genes are powerful tool to help overcome these limitations, yet to date only few studies have employed these models to tackle these limitations.
Objectives: We aim to determine the effect of ASD-associated mutations, specifically, Shank3 and Fmr1, on the integrity and functionality of the OXT hypothalamic system and to assess the effect of OXT treatment on behavioral deficits, during different developmental stages, using rat models with Shank3 and Fmr1 mutations.
Methods: To assess the integrity of the OXT system, we are applying diaminobenzidine-based method and using anti-OXT antibodies to visualize oxytocin-expressing cells within the hypothalamic periventricular nucleus (PVN) and their axonal projections to their target sites in the brain. To assess the functionality of the OXT system, we are testing the levels of OXT in the peripheral blood, brain and, cerebrospinal fluid, using micor-dialysis, ELISA, and mass spectrometry techniques. To study the effect of OXT administration on behavior, we use the social discrimination task and assess social recognition memory, which we found to be impaired in Shank3-deficits rats. We test performance of the rats on this task, before and after oxytocin intracerebroventricular (I.C.V) or intranasal administration, during different developmental periods.
Results: Our morphological analysis demonstrates that OXT-expressing neurons show increased OT immunoreactivity and dendritic swelling in *Shank3*-knockout (KO) rats, and decreased number of OXT-expressing cells in Fmr1-KO rats. We see no changes in OXT peripheral blood levels in Shank3-deficits rats. Behaviorally, we found that OXT I.C.V treatment during adulthood improves social-recognition memory deficits in Shank3-deficinet rats.
Conclusions: Our findings show that mutations in the Shank3 and Fmr1 genes disturb the integrity of the OXT hypothalamic system. Findings from Shank3-KO rats suggest that OXT release is impaired and that this impairment is specific to oxytocin release within the brain. Altogether, this implies that treatment with OXT may be beneficial in at least in two subset of individuals with ASD, with Shank3 and Fmr1 mutations, where the integrity of the OXT system could be potentially disturbed.

23 **106.023** Learning Recapitulates Development at the Epigenetic Level Highlighting Regulatory Regions Relevant for Autism and Intellectual Disability

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Background:
Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder of high prevalence that clearly involves genetic risk factors. Most current approaches aimed at identifying genetic risk factors in ASD focus on genes. However, most human disease-associated variants are located in regulatory regions that control gene expression. As such, a great number of relevant ASD genetic variants likely lie within regulatory regions. Intellectual Disability (ID), which leads to learning impairments, is the most common ASD comorbidity and the strongest predictor of poor prognosis. The genetic basis and underlying molecular mechanisms shared between learning and ASD therefore hold insights into a key aspect of these disorder.
Epigenetic modifications and regulation of gene expression are necessary for learning. Functionally relevant regulatory regions are determined through epigenetic modifications that define where chromatin is accessible in the genome. The connection between ASD and ID must be determined at least in part by epigenetic modifications that can be measured through chromatin accessibility. Defining regulatory regions relevant to ASD based on learning dependent chromatin remodeling is an unexplored yet potentially fruitful target for investigation.
Objectives:
The goal of this study was to determine which regulatory regions are recruited during memory consolidation and investigate whether they could highlight non-coding regions with genetic links to ASD and ID.
Methods:
We used sonication of cross-linked chromatin followed by sequencing (Sono-seq) to define how learning affects chromatin accessibility genome-wide in mice. We developed a new bioinformatics tool (DEScan) to uncover regulatory regions that show statistically significant differences in chromatin accessibility following learning. We integrated our results with publicly available datasets from ENCODE and SFARI, to better define the relationship between learning regulated regions, mechanisms of epigenetic regulation and known ASD linked genes.
Results:
Our results show that learning increases chromatin accessibility in 2,365 regulatory regions genome-wide (FDR <0.05). These learning regulated regions are bivalent promoters associated with CpG islands and show a strong bias towards being accessible during development relative to adulthood ($p<0.001$). Enrichment for active histone marks (H3K9ac, H3K4me2/3) within learning regulated regions is also higher for embryonic than postnatal datasets ($p<0.05$). Thus, our data shows that learning increases chromatin accessibility of regulatory regions that are active during development. Learning regulated regions are also disproportionally associated with known ASD genes (SFARI, $p< 0.01$). The enrichment was found at any SFARI gene evidence level, and the fold enrichment was higher at lower SFARI scores. Learning regulated regions were associated with 15 forms of syndromic ASD that also present with ID.
Conclusions:
Overall our study suggests that the high comorbidity of ASD and ID could be based at least in part on the fact that learning relies on a subset of regulatory regions that are also required for brain development. We also show that using epigenomic data obtained in mice is a viable strategy to highlight functionally relevant regulatory regions to study the contribution of non-coding genetic variation to ASD. Future studies will focus on testing whether learning regulated regions harbor non-coding genetic variants associated with ASD and ID.

24 **106.024** Longitudinal Behavioural Study of Shank3 KO Mice Combined with Rnaseq Analyses Reveals New Candidate Modifier Genes for Autism

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Background:
Autism Spectrum disorders (ASD) are neurodevelopmental conditions affecting more than 1% of the population. Diagnosis is based on two main criteria: alteration of social communication and interaction as well as repetitive and stereotyped behaviours (DSM-5). Among the ASD-risk genes, SHANK3 encodes a scaffolding protein at the postsynaptic density (PSD) of glutamatergic synapses. A meta-analysis of SHANK mutations in ASD estimated that 1-2% of patients with ASD and intellectual disability (ID) are carrying a *de novo* deleterious mutation in *SHANK3. SHANK3* is also deleted in the vast majority of the patients with Phelan-McDermid syndrome (PMS). Many patients carrying a mutation in *SHANK3* or diagnosed with PMS show a worsening of the phenotype in adolescence or early adulthood (i.e. a behavioural decline). Several laboratories have generated mouse models lacking *Shank3* to understand the biological role of this protein, but none of these studies analysed the progression of the phenotype during development.
Objectives:
In the present study, we tested whether a mouse model mutated in *Shank3*, namely *Shank3Δex11* displayed a worsening of the phenotype when aging. We therefore studied the stability of the phenotype in this mouse model by following the same individuals in adulthood, over their first year of life.
Methods:
The *Shank3Δex11* mouse model carries a deletion of exon 11, involved in the SH3 domain (Src homology 3 domain). We characterised the same individuals at 3, 8 and 12 months of age. We tested homozygous wild-type, heterozygous and homozygous knock-out littermates of both sexes. We focused on locomotion/exploration, social and stereotyped behaviours at the three times points. We conducted comparisons between genotypes at each times point, but also within genotypes over the three time points. At twelve months of age, the brain from each animal was extracted and dissected. RNA sequencing was performed on four brain regions: cortex, hippocampus, striatum and cerebellum.
Results:
At 3 months of age, the *Shank3*-KO mice displayed a significant decrease in locomotion, a significant increase in self-grooming, but mild impairments in social interactions in comparison with wild-type littermates.
Between 3,8 and 12 months of age, 7 out of 12 males and 4 out of 12 female *Shank3*-KO mice displayed a worsening of the phenotype, with a drastic increase in self-grooming. Interestingly, 4 males and 5 females *Shank3*-KO mice with a lower level of grooming at 3 months remained stable at 1 year. RNA sequencing data already revealed several genes differentially expressed between wild-type littermate and *Shank3*-KO mice. These results point at some biological pathways that could be influenced by the absence of Shank3. Further data on the comparison between the RNA level and the level of grooming will be presented.
Conclusions:
These data showed that some *Shank3Δex11* mutant individual mice displayed a worsening of the phenotype, reminiscent to what is observed in patients carrying a mutation in *Shank3*. These inter-individual variations remain to be better understood in order to identify spontaneous compensations. This should provide new pathways for innovative knowledge-based treatments.

25 **106.025** Loss of KCTD13 Decreases Hippocampal Synaptic Transmission Via the Small Gtpase RhoA

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Background: Autism Spectrum Disorder (ASD) is a complex neurological disorder that affects brain function. Copy number variations (CNVs) are implicated in autism. Deletions/duplications within the 16p11.2 chromosomal region are among the most frequent CNVs associated with neurodevelopmental disorders and are one of the most prevalent CNVs in ASD. Deletions within this region are implicated in autism and intellectual disability (ID), whereas duplications are associated with schizophrenia, bipolar, autism, and ID. Of the many genes within this CNV region, *KCTD13* has been implicated in and hypothesized as a major driver of the neuroanatomical and neurodevelopmental phenotypes. KCTD13 acts as an adaptor protein that forms a complex with the ubiquitin-ligase *CUL3*, an established autism gene. Together KCTD13-CUL3 ubiquitinate RhoA, a small GTPase that regulates many cellular processes. Interestingly, the KCTD13-CUL3-RhoA interaction has been implicated in contributing to brain size and connectivity in humans. However, little is known regarding the function of KCTD13, and its contribution to neurodevelopmental phenotypes in the mammalian brain.
Objectives: In an effort to understand how loss of *Kctd13* might contribute to 16p11.2 deletion pathology, we created a *Kctd13* deletion mouse.
Methods: *Kctd13* effects on synaptic transmission were determined using extracellular and intracellular recordings of neurons in area CA1 of hippocampus from acute slices. CA1 neuronal morphology and spine density/morphology were analyzed using Golgi-Cox staining. Hippocampal lysate was tested biochemically for alterations in total and active RhoA protein levels via western blots and G-LISA RhoA Activation Assay (Cytoskeleton) respectively. Incubation of acute slice in Rho inhibitors occurred for 3.5 hours followed by extracellular and intracellular recordings of neurons in area CA1 of hippocampus.
Results: We have specifically deleted *Kctd13* in mice and demonstrated reduced synaptic transmission correlated with decreased dendritic complexity and spine density in area CA1 the hippocampus. These alterations in synaptic transmission also correlate with increased levels of the KCTD13/CUL3 ubiquitin ligase substrate RhoA. Further, these synaptic phonotypes are reversed by selective RhoA inhibition *in situ,* confirming increased RhoA as the mechanism underlying reduced synaptic transmission.
Conclusions: These findings implicate *Kctd13* in neuronal alterations that may contribute to neuropsychiatric disorders. These data implicate a potential role for RhoA as therapeutic target in disorders associated with deletion of *KCTD13* including 16p11.2 deletion.

26 **106.026** Low Empathy-like Behavior in MICE Associates with Impaired Sociability, Emotional Memory, Physiological Stress Reactivity, and Variations in Neurobiological Regulations

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Background: Deficits in empathy, in the form of limited prosociality have been proposed to constitute a hallmark of highly prevalent child and adolescent psychiatric disturbance. Additional indices of conduct disorder are constituted by a limited sensitivity to punishment, shallow or deficient affect and reduced physiological reactivity to environmental stressors.
Objectives: Empathy has been reliably addressed in preclinical models through the evaluation of the social transmission of emotional states (physiological state matching): specifically, mice exposed to a painful stimulus display a higher response if in the presence of familiar individual experiencing a higher degree of discomfort, than in isolation. In the present study, we investigated whether a reduction of empathy can be considered a predictor of reduced sociality, sensitivity to punishment, and physiological stress reactivity.
Methods: To this aim, we first evaluated empathy-like behavior in a large group of Balb/cJ mice and then discretized their values in four quartiles. The first (high empathy) and the last (low empathy) quartile constituted the experimental population.
Results: indicate that low-empathy mice are characterized by reduced sociability, impaired memory of negative events, and dampened hypothalamic-pituitary-adrenocortical reactivity to external stressors. Furthermore, we show that low empathy mice exhibit elevated concentrations of oxytocin and vasopressin as well as reduced density of BDNF receptors in selected brain areas.
Conclusions: Thus, not only do present results translate to the preclinical investigation of psychiatric disturbances, but also they can contribute to the study of empathy in terms of its adaptive significance.

27 **106.027** Maternal Allergic Asthma during Gestation Leads to Elevated Inflammatory Cytokines in the Fetal Brain

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Background: Maternal infection during gestation is a well-established risk factor for neurodevelopmental disorders in offspring, including autism spectrum disorders (ASD). Most preclinical investigations of these risks have focused on specific responses to bacterial or viral pathogens, however data suggests that the increased risk for ASD is generally associated with maternal immune activation (MIA), specifically increases in pro-inflammatory cytokines during gestation. While MIA animal studies have traditionally focused on one arm of the immune response, allergic responses during gestation characterized by increased T-helper 2(T_H2) cytokines have recently been shown to alter offspring behavior. We hypothesized that MIA associated with asthma and allergies may also elicit changes in offspring immune responses in the brain.
Objectives: Previous MIA investigations specific to a maternal immune response to pathogens have found that MIA increases pro-inflammatory cytokines in the fetal brain compartment. We sought to determine whether activation of the allergic/T_H2 arm of the immune system during gestation would elicit differential immune responses in the fetal brain.
Methods: C57 dams were sensitized by exposures to ovalbumin (OVA) prior to pregnancy, then exposed to either aerosolized OVA or PBS-vehicle repeatedly throughout gestation until embryonic day (E)17.5, at which time fetal brains and maternal sera were collected and processed for cytokine analysis via multiplex technology.
Results: Significant elevations of inflammatory cytokines were present in fetal brains from mothers exposed to aerosolized OVA during gestation compared to vehicle control exposed dams. These cytokines included interleukin (IL)-1alpha, IL-1beta, IL-2, IL-7 and IL-9 ($p<0.001$). Elevated levels of chemokines were also present, including chemokine (C-X-C motif) ligand (CXCR)-1, chemokine (C-C motif) ligand (CCL)-3 and CCL5 ($p<0.01$). Fetal brain cytokines positively correlated with gestational maternal sera cytokine levels that are associated with an allergic asthma phenotype.
Conclusions: We demonstrated that the maternal immune responses associated with an allergic T_H2-skewed inflammation during the gestation period in mice lead to significant increases in fetal brain cytokine responses. Our findings provide support that activation of the immune response associated with allergies or asthma during gestation may alter neurobiology and subsequently contribute to the development of neurodevelopmental disorders, including ASD.

28 **106.028** Placental Group B Streptococcus Infection: Sex Specific Inflammatory Response and Autistic-like Traits in Male Offspring

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Background: Group B *Streptococcus* (GBS) infection is one of the major causes of chorioamnionitis, which is a risk factor for preterm birth and autism spectrum disorder (ASD). Chorioamnionitis affects the placental synthesis of neurotrophic factors, and triggers the release of neurotoxic inflammatory mediators, such as interleukin-1 (IL-1), which might disrupt myelinated neuroglial fiber tracts. We previously showed, using a new rat model, that GBS-induced maternal infection leads to sex-specific forebrain injuries and ASD-like traits in the offspring. Male offspring from GBS-exposed dams presented developmental impairments characterized by ASD-like behaviors with defective: communication, social interactions, and sensory integration. GBS-exposed dams displayed chorioamnionitis characterized by a higher infiltration of polymorphonuclear cells in male than female (*Allard et al., Autism Research, 2016*). Our hypothesis is that maternal exposure to GBS impacts the placenta through an IL-1 driven inflammatory response leading to brain injuries and ASD-like traits in the offspring.
Objectives: To characterize GBS-induced inflammation on the placenta, and its specific effects on the offspring' developing brain.
Methods: Â Lewis dams were inoculated intraperitoneally on gestational day 19 with live serotype Ia GBS (10^8 CFU). Caesarian-sections were performed at multiple time points following the infection to collect placentas, and maternal and fetal blood samples. The maternofetal inflammatory response was studied by ELISA and immunohistochemistry. Behavioral tests were performed from postnatal day (P)7 to P40 to assess ASD-like behaviors. Brains were collected at P40 for histological studies. Magnetic resonance imaging and diffusion weighted imaging were performed on young adult rats.
Results: GBS placentas were infected, but did not result in pups' infection. Following GBS infection, increased titers of IL-1β were detected in maternal blood, male placentas, and male fetuses' blood, *vs* control tissues. At P40, GBS-exposed males showed a reduced thickness of the external capsule, of the frontal neocortex and of the corpus callosum, with a decreased mean fractional anisotropy in the anterior part of the corpus callosum. Increased hippocampus areas and increased thickness of the cingulum were also measured in GBS-exposed males at P40, compared to male controls. None of these differences were observed in GBS-exposed females. Placental inflammation and forebrain injuries will be further characterized by ongoing studies.
Conclusions: Exposure to live GBS induces maternofetal immune activation resulting in neurodevelopmental abnormalities recapitulating those of human ASD, including sex dichotomy and behavioral phenotype. Our findings pave the way towards the use of IL-1 blockade in therapeutic trials aimed to prevent ASD arising from GBS infection, a common and modifiable gestational environmental factor.

29 **106.029** Polygenic Contribution of the Transcription Factors Gtf2i and Gtf2ird1 of the William's Syndrome Critical Region to Produce Disease Relevant Phenotypes

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Background:
Chromosome region 7q11.23 contains dosage-sensitive genes that affect social behavior. The duplication of the region is associated with autism spectrum disorders (ASDs), whereas the reciprocal deletion causes William's syndrome (WS), a neurodevelopmental disorder characterized by increased social motivation but impaired social interactions. There are 28 genes present at the locus making genotype-phenotype correlations difficult to discern, and it is possible that more than one gene in the locus contribute to the social phenotype. Human and mouse studies have highlighted two paralogous transcription factors, *GTF2I* and *GTF2IRD1*, as contributing to the social and anxiety phenotypes. However, prior mouse models that studied these genes individually failed to test the impact of epistatic genetic interactions.
Â Objectives:
Using newly developed mouse models, we aim to test the hypothesis that the two transcription factors, *Gtf2i* and *Gtf2ird1*, interact genetically to affect behaviors related to ASD and WS.
Methods:
We have generated two knockout mouse lines, *Gtf2i*$^{+/-}$ and *Gtf2ird1*$^{+/-}$, using the CRISPR/Cas9 system. Crossing these two lines yields four genotypes in the offspring: wild type, *Gtf2i*$^{+/-}$, *Gtf2ird1*$^{+/-}$, and *Gtf2i*$^{+/-}$/*Gtf2ird1*$^{+/-}$ double mutants. A cohort of these animals (n=83) was run through a battery of behavior tests to assess developmental behaviors, such as maternal separation induced ultrasonic vocalization (USV) and juvenile play, and adult behaviors, such as the sensorimotor battery, open-field, social approach, marble burying, object recognition, T-maze, and tube-test of social dominance. This breeding scheme allows us to determine the main effects of each gene as well as test for genetic interaction between the genes on behavioral performance.
Results:
We show that each gene has a main effect on certain behaviors, but there also exists behaviors that are affected by the interaction of the two genes. During development we see that *Gtf2i* mainly affects the pitch at which pups emit USVs, but that *Gtf2i* and *Gtf2ird1* interact to affect the duration of the USVs. Furthermore, in adulthood we see that *Gtf2i* mutation alone is sufficient to induce hyper-activity, while *Gtf2ird1* mutation alone is sufficient for anxiety-like phenotypes in the open field. Interestingly, we see genetic interactions on multiple behaviors including balance of the mice in the ledge task, and the number of marbles buried during a task of repetitive digging behavior. Finally, we see robust interaction in a social phenotype, the tube test, where only the double mutant mice show a subordinate phenotype.
Conclusions:
Using newly developed mouse lines we have shown that two transcription factors located within a region that is associated with two developmental disorders (ASDs and WS) contribute individually to specific phenotypes such as anxiety and hyperactivity but also interact to affect social and motor behaviors, suggesting the related human disorders may also be polygenic in etiology.

30 **106.030** Preliminary Characterization of Dosage Effects of UBE3A on Cognitive and Motor Phenotypes in Mouse Models

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Background: The ubiquitin protein ligase E3A gene (UBE3A) is located in the 15q11-q13 region of the genome. Mutations within this region have been associated with various types of neurodevelopmental disorders, which suggests UBE3A is dosage-sensitive (Beaudet, 2011; McNamara & Isles, 2013). Maternally derived deletions, mutations, or epimutations that lead to a loss of expression or function of UBE3A cause Angelman syndrome (AS, Jiang et al., 1999), while elevated UBE3A is hypothesized to cause Dup15q syndrome. The discovery of a patient with a severe developmental delay contributed to the idea of gene-dosage effects. In this case study, a maternally inherited 129 Kb duplication in chromosome region 15q11.2 encompassing only the UBE3A gene was described (Noor et al., 2015). Studies of (D)UBE3a in Drosophila (Ferdousy et al., 2011; Hope et al., 2016; Jensen et al., 2013) and rodent models (Daily et al., 2011; Hethorn et al., 2015; Huang et al., 2013) further corroborates the theory.
Objectives: The present experiments were designed to evaluate cognitive and motor phenotypes in mice with mutated *Ube3a* (deletion), similar to AS, or increased *Ube3a* (overexpression), modeling Dup15q syndrome. These domains were chosen due to the phenotypic profile of individuals with AS and Dup15q, which includes deficits in motor abilities, coordination, gait, ataxia and intellectual disabilities. Behaviorally, beam walking, rotarod and open field were utilized to test motoric abnormalities. The touchscreen spatial reversal task was chosen due to its conceptual and technical similarities to the NIH Toolbox battery used for testing cognitive functions in children with minimal demand on motor abilities (Silverman et al., 2013).
Methods: Breeding pairs were acquired from The Jackson Laboratory. Mice were bred in a conventional mouse vivarium at the University of California Davis School of Medicine in Sacramento. Motor assays (beam walking, rotarod and open field) were run according to previously published methods (Silverman et al., 2011; Stanley et al., 2005; Wohr et al., 2013). Spatial reversal was tested in the automated Bussey-Saksida touchscreen system for mice (Campden Instruments Ltd/Lafayette Instruments, Lafayette, IL, USA), using a procedure slightly modified from the methods described previously (Buscher et al., 2016; McTighe et al., 2009).
Results: *Ube3a* mutant mice displayed deficits in open field, rotarod and beam walking when compared to their WT littermates. Our data replicate and extend prior findings (Bruinsma et al., 2015; Huang et al., 2013). Preliminary data indicate impaired touchscreen training for spatial reversal in *Ube3a* mutants by requiring more days to reach criteria in each training phase compared to WT littermates. No genotype differences were detected in *Ube3a*overexpressing mice on motor tasks, while spatial reversal data is currently being analyzed.
Conclusions: The current results suggest a dosage-sensitive effect of *Ube3a* mutations on behavior indicating that an optimal dose of *Ube3a* is required for typical motoric and cognitive flexibility. Importantly, the current findings can and will be utilized as outcome measures for preclinical pharmacological and stem cell-delivered genetic intervention strategies.

31 **106.031** Preliminary Seizure Susceptibility and Threshold Characterization in Mouse Models Relevant to Angelman Syndrome and Chromosome 15q11.2-13 Duplications

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Background: Maternally derived duplications or triplications of 15q11.2-q13 (Dup15q) are one of the most common genetic variations associated with autism spectrum disorder (ASD) detected in ~1-3% of cases (Glessner et al., 2009; Pinto et al., 2010; Moreno-De-Luca et al., 2013) and are characterized by seizures, developmental delay, and minor dysmorphic features (Finucane et al., 1993, Bolton et al., 2001; Urraca et al., 2013). The severity of symptoms correlates with the number of copies of the region with interstitial duplications, causing mild to moderate phenotypes, and isodicentric duplications, associated with severe phenotypes. Angelman Syndrome (AS) is a rare (1 in 15,000 births) neurologic disorder characterized by a wide range of symptoms including intellectual disabilities, lack of speech, ataxia, and seizures (Williams et al., 2006; Jiang et al., 1998). Both AS and Dup15q are believed to be caused by the loss or overexpression, respectively, of the ubiquitin protein ligase E3A (UBE3A) (Beaudet, 2011; McNamara & Isles, 2013). While divergent in gene dosage of UBE3A, both neurodevelopmental disorders exhibit high incidence of seizures.
Objectives: The present experiments were designed to evaluate seizure phenotypes, seizure susceptibility and threshold in mutant mouse models of Dup15q and AS. To identify neuroanatomical phenotypes in these mouse models magnetic resonance imaging (MRI) was used.
Methods: Breeding pairs were purchased from The Jackson Laboratory. Mice were bred in a conventional mouse vivarium at the University of California Davis School of Medicine. We quantified spontaneous seizure occurrence through video recordings and EEG in a home-cage environment. In cases where no spontaneous seizures were observed, we tested the threshold of inducible seizures by latencies to myoclonic jerk, generalized clonic-tonic seizure, and tonic extension or death using chemoconvulsants (pentylenetetrazole [40-80 mg/kg] and/or kainite acid [20-40 mg/kg]) and/or the Ugo Basile electroconvulsive device. Whole brains were harvested from an independent cohort of mice, and ex-vivo structural MRI was performed to identify volume changes in different brain regions associated with seizure susceptibility, as previously described (Ellegood et al., 2015).
Results: No spontaneous seizures were observed in mice with deletions or overexpression of *Ube3a. Ube3a* overexpression mice did, however, exhibit faster onset to generalized clonic seizure and reduced latencies to tonic extension and death. Both deletion and overexpressing *Ube3a* mutant mice showed smaller hippocampal volume ($p<0.05$) when compared to WT controls. Data are currently being collected for seizure susceptibility in mutant mice with deletions in *Ube3a.*
Conclusions: We detected significant outcomes due to the level of expression of *Ube3a* on a variety of seizure parameters as well as neuroanatomical measures, suggesting that these mouse models are useful preclinical tools for studying neurobiological mechanisms behind epilepsy and seizure impairments in Dup15q, AS, and ASD.

32 **106.032** SHANK3 Deletion and Related Phenotypes in Chinese Children with Autism and shank3-KO Zebrafish Display Autistic-like Behaviours

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Background: Autism spectrum disorder (ASD) is well known as a heritable, debilitating neurodevelopmental disorder manifesting in early development. A mount of studies showed that *SHANK3* gene had a strong causal relationship with ASD and/or 22q13.3 deletion syndrome. However, the data of Chinese ASD patients with *SHANK3* deletion is insufficient and the mechanism is not clear.
Objectives: N/A
Methods: MLPA and Sanger sequencing were carried out to confirm the *SHANK3* deficiency of Chinese children. Moreover, systematic and comprehensive evaluations were performed to Chinese-specific features. In addition, *shank3* was knock-out (KO) using a CRISPR/Cas9 system in zebrafish to build a transgenic zebrafish model.
Results: As to the patients, six participants lacked the whole gene of *SHANK3* with 22q13.3 deletions ranging in size from 55 kb to 4.8 Mb and three participants with de novo SHANK3 mutation were included. They were characterized by high rates (100%) of ASD, developmental delay, hypotonia, several dysmorphologies and perception abreaction. New and rare features were also viewed in this study: ectropion of nostril sparse hair, ankle deformity, whole-body hairy, hanked-3-lap arms, snaggletoothed or extra teeth and unusual-dehydrated skin, and extreme hyperactivity/self-sitimulation. As to the zebrafish model, the shank3-KO zebrafish displayed varying degrees of developmental retardation compared with the wild-type zebrafish, such as ventral curled body, less melanin, less somites and so on. Moreover, the homozygous zebrafish were more significant than the heterozygotes. What's more, in zebrafish social interaction test, shank3-KO zebrafish showed less interest exploring conspecific zebrafish both in swimming distance ratio and swimming time ratio. Furthermore, in zebrafish social preference test, shank3-KO zebrafish displayed reduced polarization of fish shoals, looser and larger schools, and higher percentage of fish leaving the group and spending time outside the shoal which implied a disorganized social structure. In addition to social deficits, the trace pattern analysis of zebrafish found several obvious behavioral stereotypies, such as repetitive, stereotypic "repeated self-rotation" swimming behavior.
Conclusions: Â In our study, the severity of intellectual, hypotonia, and speech impairments were seen in *SHANK3* deficiency which highlighted the prominence of SHANK3 in ASD. Zebrafish, a typical animal model, will play a critical role in further studying the relationship between phenotype and genotype of ASD and insighting into the molecular mechanisms underlying the clinical heterogeneity of ASD.

33 **106.033** Social and Non-Social Reward in Mouse Models of Autism

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Background:
The social motivation theory of autism posits that social interaction may be less rewarding for individuals with ASD than typically-developing individuals. However, it has also been suggested that reward processing may be affected more globally in ASD. Mouse models present a promising opportunity to explore how these competing explanations may apply in a variety of ASD etiologies, including ASD-associated genetic mutations. The Fmr1 knockout mouse model of Fragile X Syndrome has been previously shown to exhibit deficits in reward learning, and here we extend these findings to several other genetic models including Celf6 and Nf1 mutants, representing an ASD candidate gene and syndromic form of ASD respectively.
Objectives:
We employed the conditioned place preference assay to measure reward learning in several genetic mouse models of ASD, with the goal of establishing whether any deficits are global or specific to social rewards.
Methods:
In the conditioned place preference assay, mice are conditioned to associate one side of a three-chamber apparatus with a particular reward. Time spent on this side of the apparatus is compared before and after conditioning, and a significant increase indicates that the animal was sufficiently rewarded to learn the association. To assess non-social reward, we injected the mice with cocaine on the conditioned side and saline on the opposite side. Acute locomotor sensitization to cocaine was also measured by total distance traveled in the drug-paired side on each day of conditioning. A social reward version of this task is ongoing, in which mice are exposed to social interaction instead of cocaine.
Results:
Consistent with the global reward impairment hypothesis, cocaine conditioning was not observed in the Celf6 knockout line, indicating a general lack of reward response. Celf6 knockout mice did not show a significant preference for the cocaine-associated chamber after three days of conditioning, in contrast to wildtype littermates. They also did not exhibit typical cocaine sensitization during conditioning, suggesting a lack of acute response to the reward. We also examined reward conditioning and acute responses in the Nf1+/- model of neurofibromatosis, a syndromic form of ASD.
Conclusions:
We have confirmed global reward learning abnormalities among a subset of genetic mouse models, suggesting that reward deficits in ASD may exist beyond impaired social motivation.

34 **106.034** Sulforaphane Improved Social Communication Impairment with Upregulation of Gabaergic Pathway in Cerebral Cortex of Valproic Acid Induced Autism

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Background: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that is characterized by deficits in social communication, and restricted repetitive pattern of behavior. The etiology of ASD has not yet been defined due to its multiple factors. Valproic acid (VPA), which is for treating epilepsy and depression, has been reported to induce ASD by prenatal exposure in clinical cases and animal model. Current pharmacotherapies are still in clinical trial stages. Sulforaphane (SFN), which is an isothiocyanate derived from vegetables like broccoli, has been showed to ameliorate the social communication impairment in clinical trial. Our previous research demonstrated that that SFN can ameliorate of social impairment in VPA induced mouse model. However, the possible mechanism has not been realized yet.
Objectives: This study aimed to investigate the mechanism of SFN effects on VPA mouse model. Besides, the pathway will be studied in respect to the pathogenesis and treatment of ASD.
Methods: Pregnant BALB/c albino mice were injected intraperitoneally with VPA (600 mg/kg) on embryonic day 12.5, while the PBS group mothers were given with PBS as control group. On postnatal day 28, male pups from VPA-injected mothers were verified the autistic feature by three chambers sociability test. Mice with autistic feature were randomly assigned into SFN treatment group and VPA group. The SFN treatment group (VPA-SFN) mice was given with SFN (3.854 mg/kg/day) by oral gavage; while the VPA and PBS group were fed with saline (VPA-SAL). All groups were fed daily for 22 days. All mice were euthanized on postnatal day 50 and the cerebral cortices were harvested to perform Western Blot and immunohistochemistry analysis of presynaptic glutamic decarboxylase GAD67 and GABAergic receptors including GABRα1, GABRα5 and GABRβ2.
Results: For presynaptic protein, the protein levels of GAD67 were significantly repressed by 77.1% ($p < 0.05$) in VPA mice as compared with PBS group. SFN group showed up-regulation of GAD67 (26.4%, $p < 0.05$) respective to VPA mice. For postsynaptic receptors, expression levels of GABRα1, GABRα5 and GABRβ2 were down-regulated by 29.2% ($p < 0.05$), 15.4% ($p < 0.01$) and 33.0% ($p < 0.05$) significantly in VPA group, while in SFN treatment group, expression levels were rescued by 17.7% ($p< 0.05$), 71.9% ($p<0.05$) (comparable to PBS group), and 44.3% ($p<0.01$) respectively. In the fluorescent histochemistry, SFN treated mice showed intense signals of GAD67, GABRA1 GABRA5 GABRB2 in cerebral cortex, similar to PBS group but less signals in VPA group.
Conclusions: Sulforaphane ameliorates the inhibition of GABAergic proteins in valproic acid induced autistic mice.

35 **106.035** The Association of ASD-like Behavior, Inflammatory Signaling, and Oxidative Stress Cascades in Semaphorin 3F KO Mice

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Background: The neuropathology of all neural circuits in ASD are dependent on changes in functional connectivity via the excitation/inhibition (E/I) ratio. The changes in E/I ratio impact routine neurotransmission, synaptic plasticity, and network function. We were the first to publish an extensive investigation of an animal model of autism and epilepsy (Barnes et al., 2009). The semaphorin/neuropilin gene family, an ASD associated set of genes, are guidance cues that control processes and cell motility in a wide variety of tissues including the CNS, heart, lung, kidney, and immune system. In the developing brain, these cues control interneuron migration/cell numbers, regulate neurite outgrowth (axon/dendrite), and control both GABA/excitatory synaptogenesis.
Objectives: The objective was to define the associations between inflammation, oxidative stress, and ASD-like behaviors.
Methods: Several groups, including our own, have noted behavioral phenotypes consistent with autism in both the semaphorin 3F and neuropilin 2 (NRP2) knockout mice. Since we observed decreased cell numbers of fast spiking Parv+ interneurons in NRP2 KO mice, we created cell specific knockouts of the ligand Semaphorin 3F (Sema 3F). The interneuron cell numbers, behaviors, inflammatory cascades, and oxidative stress signaling were investigated in these mice.
Results: Similar to NRP2 KO mice, the interneuron specific but not excitatory neuron specific knockout of Sema 3F had decreases in Parv+ and NPY+ interneuron and increased epileptogenesis. As a group, these animals had decreased social behaviors and increased repetitive behaviors compared to wild type littermates. The Sema 3F-NRP2 system signals through the NADPH oxidase MICAL1/2/3 to control the rac/rho mediated growth cone collapse via CRMP2. Interestingly, Judy Atwater and colleagues at the UC Davis MIND institute detected an auto-antibody against CRMP2 among the maternal inflammatory response which correlated with an ASD diagnosis. The staining for oxidative stress markers (4HNE, DHE), iNOS, and 3-nitrotyrosine (markers of inflammation) suggest increased products both within the glia and neurons of the interneuron specific Sema 3F conditional KO mouse. At least one marker of microglial activation Iba1 is increased in these same mice.
Conclusions:
Thus, although this is a single ASD associated gene KO mouse, these data strongly suggest that genetic mouse models of autism with markers of inflammation will be an excellent tool to investigate the role of genomics, environmental factors influencing the immune system (metals, obesity), clinical endophenotypes, and metabolic conditions. Most importantly, these models and others can define molecular mechanisms influencing the interactions among organ systems contributing to ASD brain dysfunction.

36 **106.036** The Effects of Maternal High Fat Diet on Behavioral Measures in C57BL/6J and BTBR T+ Itpr3tf/J Offspring.

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Background: The etiology for most cases of autism spectrum disorder (ASD) is unknown at this time. There is strong evidence for the genetic role in ASD but environmental factors also have a modifying role. One potential environmental factor is the maternal diet during pregnancy. Obesity before and during prenatal development increases the vulnerability of affective disorders including schizophrenia and ASD. Prenatal maternal obesity has been shown to be a risk factor for ASD and other developmental disabilities (Krakowiak et al. *Pediatrics* 2012;129;e1121),
Objectives: The objective of these experiments was to determine if a maternal high fat diet increases autistic-like behaviors in the offspring. A commonly used inbred mouse strain, C57BL/6J and a mouse model of ASD, the BTBR T^{+} *Itpr3*^{tf}/J (BTBR) were used.
Methods: Female mice were placed on either a high fat diet (60 kcal% fat D12492, Research Diets Inc, NJ) or a control diet (45 kcal% fat D12451, Research Diets Inc, NJ) for 2 weeks and then mated. The dams remained on the diet through weaning and then were placed on regular mouse chow. Both male and female offspring were behaviorally phenotyped as adults. One female and male per litter were used in up to four tests, each test at least 2 days apart.
Results: Preliminary data suggests that the prenatal high fat diet lowered the sociability in male C57BL/6J mice and to a lesser extent in the female C57BL/6J mice as well. The trend was the opposite in the BTBR mice where the controls were less social than the mice prenatally exposed to the high fat diet. The high fat diet did not have affect anxiety-like behavior the BTBR mice and the C57BL/6J male mice, but increased anxiety-like behavior in the C57BL/6J female mice. The high fat diet did not affect anxiety-like behavior, motor behavior, or exploratory behavior in the offspring.
Conclusions: Maternal obesity is a risk factor for ASD and the preliminary data demonstrated changes in social behavior and anxiety-like behavior that was both strain and sex dependent.

37 **106.037** Toll-like Receptor-Selective Placental Vulnerability, Fetal Brain Impairment, and Post-Natal Behavioral Deficits in Mouse Models of Neurodevelopmental Disorder

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Background:
Neurodevelopmental disorders (NDD), such as autism and schizophrenia have a diverse and multi-faceted etiology that is poorly understood, though epidemiological studies suggest that environmental risks such as prenatal infections or other gestational immune events correlate with increased NDD risk. Innate immune responses are evoked by toll-like receptor (TLR)-dependent signaling pathways. Both bacterial- (TLR4-selective) and viral- (TLR3-selective) mimetic-mediated maternal immune challenges have been shown to result in brain and behavioral changes (as reviewed by Meyer 2014), however, differences in methodologies prevent the direct comparison of the TLR-selective effects.
Objectives:
Previously, we demonstrated that a TLR4-selective insult at embryonic day 12.5 (E12.5) has adverse effects on fetal and placental health, proliferation of radial glial cells, altered cortical laminar patterning in the adult and behavioral deficits (Carpentier et. al 2013). Here, we aim to directly determine the differential effects of TLR3- and TLR4-selective agonists on a similar set of assays.
Methods:
Pregnant mice were challenged with a TLR3- or TLR4-selective insult on E12.5 and placental pathology and pregnancy outcomes were evaluated by quantifying tissue necrosis and fetal survival, respectively. Neocortical alterations in the developing fetuses were examined via immunohistochemistry for markers of cell proliferation and neural progenitor cell populations. Finally, behavioral outcomes were measured using tasks that evaluate behaviors analogous to the symptoms of NDDs, including pup ultrasonic vocalizations, juvenile play, social approach, and pre-pulse inhibition.
Results:
Our results indicate that bacterial and viral immune insults differentially affect placental health, fetal viability and early embryonic brain development. Post-natal behavioral outcomes also appear divergent with the TLR3-mediated insult leading to a more pronounced behavioral phenotype in the offspring.
Conclusions:
These findings suggest that specific immune events create differential outcomes for the health of the placenta and fetus and lead to distinct changes in cortical patterning which can ultimately manifest as unique behavioral symptoms. Our results have implications for understanding how similar environmental insults may lead to distinct developmental disorders or contribute to the heterogeneity of a specific condition.

Poster Session

38 **107.038** A Longitudinal Study of Gestures Used By Mothers of Infant Siblings of Children with Autism Spectrum Disorder

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Background: Â Typically developing children develop gestures before speech, and differences in types of gestures predict their future language ability (Iverson & Goldin-Meadow, 2005). Environmental factors, particularly parental behavior, influence child language development. Maternal gesture rates closely relate to infant gesture rates, which, in turn, predict language development (Rowe et al., 2008). Diversity of maternal speech was shown to predict concurrent and later child language ability (Rowe, 2012). Children with autism spectrum disorder (ASD) show language and gesture delays as early as 12 months (Özçalışkan et al., 2015). Infants with an older sibling with ASD are at higher risk for ASD and also show delays in language and communication. Talbott et al. (2015) reported that mothers of 12-month high-risk infants who were not later diagnosed with ASD (HRA-) gesture more than mothers of both infants later diagnosed with ASD (HRA+) and low-risk controls (LRC). For HRA- and LRC infants, these gesture rates correlated with 18-month language scores.
Objectives: Â The current study expands on previous research by studying maternal gestures in relation to child gestures and language longitudinally. Our research questions were a) Do mothers of HRA-, HRA+, and LRC infants differ in gestural rates at 12 and 18 months? b) Do maternal gestures correlate with child gestures? c) Do maternal gestures predict child language through 3 years?
Methods: Mothers and 12- and 18-month infant dyads (N=73, n_{HRA-}=25, n_{HRA+}=18, n_{LRC}=30) were observed during a 10 minute free-play as part of a longitudinal study. Speech and frequencies of gesture types (deictic, representational, conventional) were transcribed and coded according to a gestural coding scheme by Özçalışkan & Goldin-Meadow (2009). The Mullen Scales of Early Learning (MSEL) were administered to assess language at 12, 18, 24 and 36 months, and the Autism Diagnostic Observation Scale (ADOS) was administered to determine ASD diagnosis at 36 months (confirmed by clinical evaluation).
Results: Although mothers of HRA- children gestured more than mothers of HRA+ or LRC children, differences in total gestures were not statistically significant at either 12 (X^2=4.17, p=0.17) or 18 (X^2=0.41, p=0.52) months (Figure 1). Maternal gestures were significantly correlated with infant gestures at 12-months only for HRA+ infants (p=0.009, r=0.60, Figure 2A), and at 18-months only for LRC infants (p=0.002, r=0.54, Figure 2B). Maternal gestures at 12-months were positively correlated with child gestures at 18-months only for LRC infants (p=0.016, r=0.44; Figure 2C). Total maternal gestures were not significantly correlated with concurrent or later infant language scores for any of the three groups (p>0.1).
Conclusions: These results demonstrate that mothers of high-risk infants have similar gestural communication qualities as mothers of low-risk infants. Maternal gestures at 12- and 18-months correlated with LRC infant gestures at 18-months, suggesting a more robust relationship between mothers and LRC infants. However, high-risk 18-month infants had no such relationships, suggesting a lack of synchrony during communication. Understanding the nature of communication synchrony between mother-child informs the development of quality early interventions. Future analyses will focus on the interconnection and communicative synchrony between mother and child, and child contributions to conversation.

39 **107.039** A New Approach for Eliciting Expressive Language Samples: Elsa

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Background: Emergence of expressive language is one of the strongest predictors of positive outcomes in individuals with ASD (Howlin et al., 2004; Venter et al., 1992). Language abilities also play an important role in social communication, which places them at the center of numerous interventions, and consequently requires the use of reliable and valid language measures for their assessment. Natural language samples collected across variety of contexts provide great measures of speakers' expressive language (Tager-Flusberg et al., 2009). Yet, no protocol for language elicitation has been specifically designed for individuals with ASD across a range of ages and language abilities. This is particularly important considering that language ability is one of the most variable characteristics of diagnosed individuals with 30% failing to acquire functional speech (Kjelgaard & Tager-Flusberg, 2001). Many studies rely on the ADOS as a language sampling context. However, presenting participants with different presses and activities depending on the module administered might influence language measures.
Objectives: We aim to evaluate a new Eliciting Language Samples Assessment (ELSA) protocol for individuals with ASD across a range of ages and language ability. The study focuses on its use with minimally verbal children with ASD, arguably the most challenging group from whom to obtain language samples. We evaluated the effectiveness of ELSA in eliciting language and engaging the participants. We compared it to a different language sampling context, the ADOS.
Methods: ELSA includes multiple activities designed to engage individuals across a wide age range including going on a hike, camping, doing crafts (all carried out using a kit with relevant props and materials), watching a short video and retelling its plot, and a short conversation period. We evaluated protocol engagement by examining the duration of engagement of the participants (how long it took to go through all the activities). Utterance frequency per minute was used to assess the effectiveness of ELSA in eliciting language, and compare it to the ADOS.
Results: Participants (N=20) aged 6;7 to 18;10 spent on average 18.96 (SD=4.49) minutes engaging with ELSA. They produced an average of 3.79 (SD=3.91) utterances per minute. The frequency of utterances per minute during ELSA (*M*=3.1817) and ADOS (*M*=2.2760) approached a significant difference (*t*(8)= 2.0491, *p*=0.0746) with more utterances per minute during ELSA.
Conclusions: ELSA was successful at engaging participants across a wide age range and language ability for a prolonged period of time (Table-1). In addition, participants, even minimally verbal ones, produced speech sounds while engaging with the ELSA activities. The video component of the protocol was originally included in order to evaluate the narrative skills of more verbally fluent participants, so it might not be applicable to less verbally fluent individuals as reflected by the small number of vocalizations they produced during this portion of ELSA. Participants tended to make utterances more frequently during ELSA than during the ADOS, which speaks to ELSA's ability to elicit language. These analyses provide support for the use of the newly designed ELSA for the assessment of the highly heterogeneous language ability in ASD.

40 **107.040** A Peer-Mediated Intervention for Preschoolers with Autism Using AAC: Effects on Presymbolic and Symbolic Communication

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Background:
The Communication Complexity Scale (CCS; Brady et al., 2012) is a measure of prelinguistic and linguistic communication being validated for individuals with autism and other developmental disorders. It was developed to fill a gap in assessment of communication for individuals with complex communication needs who may have severe intellectual impairments. Often it is difficult to determine communication status for this population due to presymbolic means of communicating that may not be revealed on typical standardized assessments.
Objectives:
The purpose of this presentation is to describe how this scale is being used to measure treatment effects of a peer-mediated (PM) communication intervention for preschoolers with autism learning to use augmentative and alternative communication (AAC). The intervention teaches typically developing peers to use a speech generating device (i.e., iPad with voice output app) with a classmate with autism. Procedures of the peer-mediated AAC intervention will be described; as well as CCS outcomes for 17 children with autism in the control group and 18 children in the PM AAC treatment group.
Methods:
Each year for 3 years, 12 children with autism and 1-3 peers per child were recruited. We conducted a series of multiple baseline designs, within an embedded randomized control design with 6 children assigned to an iPad only condition (control) and 6 assigned to iPad + PM condition (treatment) each year. Effects of the intervention were assessed within groups (baseline to treatment) and between groups (control and treatment) for 35 children. We used the CCS to score a Structured Communication Sample: Adult Partner, and the same assessment with a Peer Partner, pre- and post-intervention. We adapted administration with a peer to provide a unique way of measuring effects of the intervention on changes in communication with peers, in addition to the typical adult assessment context. Twelve communicative temptations were presented to elicit behavior regulation and joint attention (JA).
Results:
On the CCS, children in both groups made significant changes with adult and peer partners. However, there were no differential treatment effects in score changes for children in the PM treatment compared to the control group. Calculation of effect sizes suggested a medium effect size (0.4) for changes with peer partners, compared to a small effect size (.2) with adults. Furthermore, 90% of children in the PM treatment and 75% of children in the control group improved from intentional non-symbolic to intentional symbolic communication. Closer analysis of JA behaviors revealed low rates and no significant changes for either group in JA with adults or with peers.
Conclusions:
Following a peer-mediated AAC intervention, we found treatment effects on communication complexity for preschoolers with autism using the CCS - a developmental scale assessing pre-intentional to intentional symbolic communication. Outcomes provide preliminary support that this tool can be used to assess early communication behaviors, and provide a means to measure effects of social communication interventions for this population. Further, early interventions that include peers should consider teaching JA within play, given the relationship of this early core skill to later social communication skills.

41 **107.041** Acquisition of Nouns in Young Children with ASD: Insight into Learning Processes from Item Analyses

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Background: Â In typical development (TD), vocabulary acquisition has been proposed to result from domain-general associative learning, which, together with statistics in the environment, predicts word learning patterns (McMurray, Horst, & Samuelson, 2012). The size and contents of children's vocabularies support these patterns (Perry & Samuelson, 2011; Samuelson & Smith, 1999). For example, TD children who demonstrate a shape bias also produce many count nouns, especially those that are organized by shape rather than material (that is, most early nouns are solids, organized by shape, and count nouns; Perry & Samuelson, 2011; Samuelson & Smith, 1999). Children with autism spectrum disorder (ASD) fail to show a shape bias (Potrzeba, Fein, & Naigles, 2015; Tek, Jaffery, Fein, & Naigles, 2008), possibly because their lexicons are organized differently (e.g., not dominated by solid+shape+count nouns). We test this by examining the solidity, syntax (i.e., count vs. mass), and category organization (i.e., shape, color, material) of nouns in the receptive and expressive vocabularies of matched samples of toddlers with ASD and TD.
Objectives: Â We asked: (1) do toddlers with ASD, like TD toddlers, understand and produce more nouns on the "shape side" (solid+shape+count; e.g., cup, block) than on the "material side" (nonsolid+material+mass; e.g., rain, milk)? and (2) are "shape side" nouns acquired first such that they represent a higher proportion of nouns in children with small vocabularies?
Methods: Â TD toddlers (*n*=46; *M* age=19 months) and toddlers with ASD (*n*=39; *M* age=32 months) were drawn from a longitudinal study. Expressive and receptive vocabulary were assessed using parent report (MacArthur-Bates Communicative Development Inventories [CDI]: Word and Gestures; Fenson et al., 2007).Â Groups did not differ on number of nouns produced,*p*=.700, *d*=0.08.
Nouns from the CDI (*n*=209) were coded following Samuelson and Smith (1999) for each toddler's lexicon. The proportion of nouns characterized by solid+shape, nonsolid+material, solid+count, and nonsolid+mass was calculated.
Results: Like the TD children, those with ASD understood and produced many more solid+shape than nonsolid+material nouns, *p*s<.001, and many more solid+count than nonsolid+mass nouns, *p*s<.001. See Figures 1 and 2.Â The proportion of noun types was not correlated with vocabulary size in either group after controlling Type I error.
Conclusions: Overall, these findings suggest that the regularities proposed to support learning biases are present in the vocabularies of children with ASD: "shape side" nouns dominate the vocabularies of children in both groups regardless of vocabulary size. Despite this, their performance reveals no consistent shape bias during word learning (Potrzeba et al., 2015). It is possible that children with ASD, rather than lacking the data (vocabulary) are instead lacking the processes by which the data could be analyzed. That is, the process of lexical learning may develop distinctly in children with ASD due to the ways in which or the extent to which these regularities and their organization are utilized over time (Ellawadi, Fein, & Naigles, 2016; Tek et al., 2008). The current study has implications for theories of lexical acquisition in ASD, including shared mechanisms with typically developing children and the role of prior knowledge.

42 **107.042** Adults with ASD More Rigid When Establishing Common Ground during a Referential Communication Task

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Background: Â A speaker's ability to manage shared knowledge, or common ground, with a listener is a fundamental aspect of pragmatic language, which in turn is an area of deficit common to autism spectrum disorder (ASD). Common ground management problems observed in individuals with ASD include verbosity (de Marchena & Eigsti 2016), overspecification, and ambiguity caused by pronoun or article-definiteness reversal (Graf & Davies 2014). But little research has examined how interlocutors come to agree on the terms used to describe shared referents. The current study examines whether speakers with ASD choose their own or their interlocutors' word labels for novel figures in a dyadic referential communication task.
Objectives: Â To gauge flexibility in forming common ground.
Methods: Â Adults with ASD (*n*=12) and age-, gender, and IQ-matched controls with typical development (TDC; *n*=8) completed a collaborative referential communication task designed to elicit spontaneous back-and-forth conversation in a controlled setting. (Data from 12 additional participants with ASD, and 16 additional TDCs will be available by IMFAR2017.) Participants were shown a grid of eight abstract figures and tasked with describing them to a confederate—blind to the figures' arrangement—with the shared goal of ordering them correctly. Each participant-confederate dyad completed 5 trials (or grids), each presenting the same set of eight figures in a unique order, so that participants described each figure 5 times. Speech was transcribed, and participant's descriptions for each figure in trials 2-5 were rated with respect to the descriptions used in immediately preceding trials. Descriptions in subsequent trials either reflected each participant's own descriptions from the previous trial, the confederate's, both, or neither.
Results: Â Participants in both groups referred to figures largely using their own (52%) or their interlocutors' (40%) terms from immediately preceding trials, and rarely use both (5.3%) or new terms (2.4%). There were group differences in the proportions with which participants used their own, their interlocutors', both, or neither's terms ($p<.05$), and trending differences particularly in the second trial ($p=.077$). Over trials 2-4, odds ratios indicate that the odds of a participant's using their own terms were 1.148 times higher for the ASD than the TD group. For trial 2, the odds ratio was 1.62.
Conclusions: For both groups of adults with typical development and with ASD, there was variation in usage of participants' own, versus their interlocutors' terms when referring to previously described novel figures. These variations differed between groups. Adults with ASD were more likely to use their own terms than their interlocutor's, potentially reflecting rigidity known to be associated with ASD. Use of one's own description implies a refusal of one's interlocutor's terms, and lead to difficulty achieving or maintaining common ground in conversation.

43 **107.043** Adults with ASD Show Strengths and Weaknesses in Conversation during a Referential Communication Task

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Background:
Although social-communication deficits are central to Autism Spectrum Disorder (ASD), little research has examined how communication changes in real time as social interactions unfold. In typical populations, conversational partners become more efficient communicators as they establish a shared vocabulary, or *common ground*. Other subtle phenomena, such as matching word choice, syntax, and prosody, as well as mimicking one another's hand gestures, are also observed. Some research shows that individuals with ASD employ a range of these skills; for example, interlocutors with ASD *do*establish common ground with interactive partners, pointing to pragmatic strengths in this population. The current study extends prior research by including information about nonverbal communication – specifically, co-speech hand gestures.
Objectives:
To identify how patterns of behavior change as conversation progresses over time.
Methods:
Adults with ASD (n=24) and age-, gender, and IQ-matched typically developing controls (TDC; n=10) completed a five-trial collaborative referential communication task designed to elicit spontaneous back-and-forth conversation in a controlled setting (analyzed data on 14 remaining TDCs will be available by IMFAR2017). Participants were shown a grid of eight abstract figures and tasked with describing the figures to a confederate with the goal of ordering them correctly. Each trial included the same stimuli in a different order, thus participants described each figure 5 times. All hand gestures were tagged and coded for how much *supplementary information* (i.e., information not present in speech) they included, and for their *size* of execution.
Results:
Participants in both groups performed very well on the task (96% accuracy). The pragmatic manipulation employed by this paradigm (i.e., prompting participants to describe the same stimuli across five trials) was effective; all participants took the longest on trial one, describing the items more quickly on each subsequent trial (main effect of trial: p<.001, Cohen's d=3.27; see **Figure 1**). There was no change in how much *supplementary information* was presented in gestures, in either group (main effect of trial: p=0.26, Cohen's d=0.38). In contrast, the *size* of participants' gestures dropped significantly between the first and second trials (main effect of trial: p=.01, Cohen's d=1.06), with a marginally significant group by trial interaction (p=0.11, Cohen's d=0.67; see **Figure 2**), driven by no change in gesture size in the TDC sample (p=.49, Cohen's d=0.16) and a significant drop in gesture size in ASD (p=.003, Cohen's d=0.81).
Conclusions:
Like controls, adults with ASD shorten their discourse as conversation unfolds, consistent with recent findings that adults with ASD are responsive to common ground manipulations (Nadig, Shivani, & Sasson, 2015). Across groups, co-speech gestures presented the same amount of supplementary information throughout the task, suggesting that the *content* of nonverbal communication remains consistent throughout conversation. However, group differences were marginally significant in changes in gesture *size*, which may be a marker of engagement or effort exerted in the interaction. While TDC participants maintained their gesture size, participants with ASD showed a sharp decrease in gesture size between trials, potentially reflecting a decrease in social motivation as the task (and thus, the interaction) becomes less novel and engaging.

44 **107.044** Anxiety, Language, and Heart Rate Variability in Autism Spectrum Disorders

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Background:
Anxiety concerns are commonly experienced in children with Autism Spectrum Disorder (ASD) (Kerns et al., 2014). Despite this, those with both ASD and language difficulties are reported to experience less anxiety than those with less language difficulty (Kerns et al., 2014).Â Using objectively measurable biomarkers of anxiety (e.g., reduced heart rate variability; HRV) that do not rely on language ability may provide a way to improve anxiety assessment in Minimally-Verbal ASD (MV-ASD), but first more must be known about the relationship between HRV, anxiety and language. Social Engagement Systems theory, a sub-portion of the Polyvagal Theory, suggests that children with ASD experience deficits in a "social communication circuit" (Porges, 2007). Additionally, it has been shown that, much like anxiety, receptive language can be predictive of lower HRV (Patriquin, Scarpa, Friedman, & Porges, 2013). These studies provide a framework for the relationship of language or anxiety to HRV individually however few studies have looked at the interactions between HRV, language and anxiety.
Objectives:
In a sample of children with ASD it was hypothesized that RSA would be predicted by anxiety and receptive language abilities such that more anxiety and higher receptive ability will result in lower RSA.
Methods:
Participants consisted of 23 children (18 males) age ranged from 51 months to 95 months (mean = 68.70, SD = 14.07). Anxiety was measured by parent report using the Developmental Behavior Checklist, Parent Version- Anxiety Subscale (DBC-P; Einfeld & Tonge, 1992, 1995, 2002). Receptive language was measured using the Peabody Picture Vocabulary Test, Third Edition (PPVT-III; Dunn & Dunn, 1997), which was administered to children during the study visit. Additionally, children watched a 3-minute baseline video, which allowed for the measurement of baseline HRV via LifeShirt! (Vivometrics).
Results:
The model tested the prediction of parent-reported anxiety (DBC-P) and receptive language ability (PPVT-III) and their interaction with HRV (as measured by RSA). Child demographic variables such as age and gender were not correlated to RSA and therefore no covariates were included in the regression analysis. As shown in previous studies, PPVT-III was uniquely and positively related to RSA (βÂ = .545,Â *p*Â = .011). However, neither anxiety nor the interaction term was significant (βÂ = .072,Â *p*Â = .713, βÂ = -.170,Â *p*Â = .075 respectively). The full model with the interaction term was not significant (p = .052); however, the model with level 1 predictors explain 31.6% of the variance in RSA (F(2,19) = 4.390, *p* = .027).
Conclusions:
These findings indicate that, consistent with the Polyvagal Theory of the Social Engagement System (Porges, 2007) and previous studies (Patriquin, Scarpa, Friedman, & Porges, 2013) receptive language seems indicative of lower RSA. However, anxiety does not seem indicative of lowered RSA in this population, and the relationship between anxiety and RSA also does not appear to be moderated by language. This finding is surprising given the existing research on anxiety and HRV. These results may be due to parent-report not being an accurate reflection of child anxiety.

45 **107.045** Cardiac Autonomic Function Predicts Pragmatic Language Features of the Broad Autism Phenotype in Mothers of Children with ASD

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Background: The autonomic nervous system is a stress regulation system that supports social engagement. Despite efforts to characterize autonomic regulation and its role in the social impairments seen in autism spectrum disorder (ASD), evidence is inconsistent, likely due to the significant heterogeneity seen in the disorder (see Klusek et al., 2015, for review). The study of the broad autism phenotype (BAP), or subtle characteristics seen in unaffected family members that mark genetic liability to ASD, offers a framework from which to study core, genetically meaningful features of ASD while foregoing confounds related to the complex clinical presentation of the full disorder. This study adopted a BAP approach to examine cardiac markers of autonomic function among parents of children with ASD, in order to lend insight into the utility of autonomic indices as biomarkers for ASD risk. Autonomic dysregulation was also examined in relation to pragmatic language (i.e., social language) difficulties, which have been documented among parents of children with ASD as part of the BAP and are thought to reflect genetic susceptibility (i.e., Losh et al., 2008).
Objectives: This study had two research questions: (1) Do cardiac autonomic markers (i.e., heart rate, respiratory sinus arrhythmia) differ across mothers of children with ASD and control mothers? (2) Does cardiac autonomic regulation relate to pragmatic language features of the BAP?
Methods: Participants included 28 mothers of children with ASD and 28 control mothers of typically developing children (*M* age=43.5 years, *SD*=9.3). The groups did not differ in age, IQ, race, or education level (*p*'s<.204). Cardiac activity was sampled in a 3-min baseline period and mean estimates for heart rate (an index of general arousal) and respiratory sinus arrhythmia (an index of parasympathetic "rest and digest" function) were derived. Pragmatic language violations were coded from a 20-min conversational interview using a modified version of the Pragmatic Rating Scale (Losh et al., 2012). Samples were coded by two independent raters and consensus scores were used, with reliability prior to consensus at ICC(3,2)=.74. General linear models tested group differences on each of the cardiac variables. General linear models also tested each of the cardiac variables, group, and their interaction as predictors of pragmatic language.
Results: The groups did not differ on heart rate (*p*=.280, η^2_p=.02) or respiratory sinus arrhythmia (*p*=.193, η^2_p=.03). Reduced respiratory sinus arrhythmia was a significant predictor of increased pragmatic language violations across both groups (*F*[1,43]=4.14, *p*=.048, η^2_p=.09).
Conclusions: Mothers of children with ASD did not show evidence of cardiac autonomic dysfunction, suggesting that autonomic dysregulation does not extend to the presentation of the BAP in females. This suggests that autonomic dysfunction in ASD may represent a secondary feature that is not associated with underlying genetic susceptibility. However, respiratory sinus arrhythmia tone did account for variation in pragmatic language variation across both groups, suggesting that parasympathetic function may mediate the presentation of BAP and ASD symptoms. Thus, autonomic regulation may play a role in social-communication competence relevant to both atypical and typical groups, and may represent a mechanistic target for intervention.

46 **107.046** Changes in the Communicative Style of Mothers of Toddlers with ASD Are a Response to the Relatively Low Frequency of Communication in Their Children from 2 to 3 Years of Age

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Background:
The British Autism Study of Infant Siblings (BASIS) is a prospective study of children with older siblings with ASD (High-Risk sibs: HR) and controls with older siblings and no history of autism in first degree relatives (Low-Risk sibs: LR). Participants are assessed at various time points from infancy until approximately 36 months of age. At each visit parents are observed playing with their child in an unstructured session.
Objectives:
To investigate the concurrent and longitudinal relationships between parents' communication style and the frequency of their toddler's expressive language in the context of a dyadic play-based interaction within a prospective study of children at risk for ASD.
Methods:
Mothers and their children were observed playing together in an ecologically valid unstructured session when the children were 2 and 3 years of age. The frequency, content and intention of parent and child communicative acts were coded from videos of these sessions. Following the 3-year visit a best estimate research diagnosis was made. Outcome categories are: Low risk controls (LR, n=19), Typically developing (HR-TD, n=40), ASD (HR-ASD, n=10) and Atypical (HR-ATYP, n=19). The latter group consists of children not diagnosed with ASD but meeting ADOS-2 and/or ADI-R ASD criteria and/or being below -1.5 SD on the Mullen Scales of Early Learning.
Results:
Eighty-eight mother-child dyads were observed at both 2- and 3-year visits. The proportion of mothers' communicative acts that were responsive to their children's communication and the overall frequency of children's communicative acts were calculated. Repeated measures ANOVAs were conducted for both variables. For parent communication there was an overall reduction in the proportion of responsive acts over time ($F(1,5.18)$, $p=0.025$, $\eta2=0.058$), but no interaction with group. There was a significant difference between groups ($F(3,4.36)$, $p=0.007$, $\eta2=0.135$): Post-hoc analysis showed that HR-ASD was lower than both the LR and HR-TD groups at the 3-year visit (p=.023 and .022, respectively). For children's communication there was an overall increase in expressive communicative acts ($F(1,40.65)$, $p<0.001$, $\eta2=0.326$) over time but no interaction with group. There was a between-group difference ($F(3,10.44)$, $p<.001$, $\eta2=0.272$), with frequency of child communication in the HR-ASD group being significantly lower than all other groups at both time points (all p<.005).
Conclusions:
Both children and their mothers showed a similar pattern of changes in communication across all groups between 2 and 3 years of age. Mothers typically shifted to a less responsive, style and theirÂ children communicated more frequently. However, the relatively more directive style of communication in the mothers of children with ASD, compared to those of typically developing children, appears to follow the persistent lower frequency of communication used by their children. This may have implications for the type of support and intervention provided for parents of young children with autism.

47 **107.047** Child Reciprocal Vocal Contingency Measure Using Automated Vocal Analysis with Children with Autism Spectrum Disorder

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Background: Â Child reciprocal vocal contingency (CRVC) is a new measure of a child's participation in reciprocal vocal interactions in natural settings. Participating in reciprocal vocal interactions could facilitate speech and language development in children with autism spectrum disorder (ASD). Thus, evaluating correlations between CRVC and language development, particularly for preverbal children, might inform use of CRVC as an early indicator of treatment response. Although initial concurrent convergent validity and the stability of CRVC has been documented, CRVC's sensitivity to change, predictive convergent validity, and divergent validity have not been evaluated.
Objectives: (a) What is the sensitivity to change of CRVC across 12 months? (b) Does initial CRVC correlate with expressive vocabulary at 4 time points spanning 18 months? (c) Does CRVC correlate with problem solving concurrently and predictively? A low correlation between CRVC and problem solving would support the divergent validity of CRVC.
Methods: Participants include 68 children aged 13 to 30 months old at study entry. Measures are displayed in Table 1. We quantified CRVC using a three-event sequential analysis to calculate the operant contingency value, which provides an index of contingency that is independent of the frequency of chance sequencing of events. Because this analysis requires long vocal samples, we used daylong Language ENvironment Analysis (LENA) audio recordings and only included participants with at least 1 hour of input near the child on the recordings. Using a computer program to classify vocalizations and compute the index of sequential association minimized human coder measurement error and vastly increased analysis efficiency.
Results: Change in CRVC across 12 months was significant (mean change = 0.037(0.077), $t(25) = 2.41$, $p = .02$). Table 2 displays correlations between CRBC, expressive vocabulary, and problem solving. Initial (Time 1) CRVC correlated significantly with expressive vocabulary at Times 2 and 4, but not Times 1 or 3. CRVC at Time 3 did not correlate with expressive vocabulary concurrently, but did 6 months later (Time 4). As predicted, correlations between CRVC and problem solving were non-significant at Times 1 and 3.
Conclusions: Overall findings suggest continued development of CRVC is warranted, despite mixed results. Positive indicators of potential clinical utility of CRVC include its sensitivity to change for initially preverbal children with ASD, correlation with expressive vocabulary but not problem solving at two time points, and its derivation using computer analysis of acoustic events without human coding, which minimizes clinician and researcher analysis time. The lack of correlation between CRVC and expressive vocabulary concurrently at some time points suggests that CRVC's utility may be restricted to children of a particular language level or across a certain time range. Future research attending to these details is required.

48 **107.048** Children with Autism Spectrum Disorder Can Demonstrate Consistent Word Learning: Expressive Language Measures of Fast- and Slow-Mapping

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Background: Â How children with autism spectrum disorder (ASD) learn new words is often examined using a fast-mapping paradigm. In fast-mapping, children are taught a new word by associating a label they've never heard before (e.g., pagoune) with an object they've never seen before. Oftentimes, assessing learning is limited to receptive language measures, such as asking children to physically indicate the correct object from an array of objects (e.g., where is the pagoune?). More recent studies have begun to include measures of slow-mapping, or children's extended learning of what the word represents beyond an initialÂ association (Norbury et al. 2010). However, prior work has not tracked the consistency of individual children's learning across multiple measures of expressive word learning,Â which would allow us to understand more subtle but important differences that may exist in word learning in ASD.
Objectives: We examined the consistency of word learning across expressive language measures of fast- and slow-mapping in children with ASD and typically-developing (TD) children.
Methods: Children (ASD n = 24, TD n = 24) were matched on age, gender, and nonverbal IQ. Children watched a video that taught the label of a novel object andÂ thenÂ participated in three different measures of expressive knowledge of the word. In word association, children provided the first word they could think of when they heard the newly taught word. In word description, children described the word, and in word production children provided the name of the object when shown an image.
Children's performance on each measure was converted into a binary score: 1 for correct target identifications and 0 for all other responses. Trials with learning across two or three measures were considered as *consistent learning* of the word. Trials with learning on only one measure were considered as *inconsistent learning*. A trial was deemed as *no learningÂ* when children did not identify the word on any measure. Children were assessed immediately after teaching and one week later.
Results: Immediately after teaching, 14 children with ASD and 18 TD children had at least one consistent learning trial across all three measures. Eight children with ASD and 5 TD children did not demonstrate any consistent learning, although they did have a minimum of one inconsistent learning trial. Two children with ASD and 1 TD child demonstrated only trials of no learning. One week later, the number of children with at least one consistent learning trial decreased (9 ASD, 11 TD), whereas more children demonstrated only inconsistent learning (10 ASD, 9 TD), or no learning (5 ASD, 4 TD).
Conclusions: These results reveal that many children with ASD, who have IQ in the normal range, can demonstrate consistent learning across all three expressive language measures, although fewer children in both diagnostic groups are consistent one week later. Future analyses will compare characteristics between children who demonstrated consistent learning versus those who demonstrated inconsistent or no learning. This work provides an important look at how children represent new words and the stability of their word learning.

49 **107.049** Coaching Parents on Effective Communicative Access for Individuals with Autism through the Use of Ipads

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Background:
Recent literature reports that 25% to 30% of individuals with autism do not have a reliable way to verbally communicate. The incorporation of augmentative and alternative communication can be an effective tool for supporting communication and social relationships. Providing parents with adequate coaching for the use of the iPad as a communication tool is promising towards broad-based implementation and long-term outcomes.
Objectives:
The goal of this study was to provide access to alternative means of communication, by investigating the effects of partner coaching using the iPad with a symbol based system for individuals with autism who are minimally verbal, and identifying the effects of these strategies on the individuals' communication skills.
Methods:
This study employed a single-case design to examine coaching parents of individuals with autism to use an iPad for communication with their child. The researcher provided weekly coaching sessions that lasted approximately 40 minutes. Parents were systematically taught elements that comprised a "circle of communication," with each element taught sequentially and introduced as the previous element was mastered. These elements and strategies included: following and expanding on an activity or topic of the individual's choice; taking turns and responding to bids of interactions and shared engagement; providing communicative structure to engage the individual and encourage participant's construction of their own response; modeling language targets; offering structured prompts; and providing contingent reinforcement. This research included 6 parent-child pairs: 6 individuals with autism and 6 parent coaches. All individuals had their clinical autism diagnosis confirmed with the Child Autism Rating Scale.Â The children's ages ranged from 11 to 14 years old, the parents ages ranged from 40 to 48 years of age, and all parents had bachelor's degree. This was a diverse group of participants including two White Americans, two Asian Americans, one African American, one Mixed race (Asian and Latino).
Results:
Preliminary results after 10 to 12 intervention indicate that parents were able to learn to follow their child's lead in their choices of activities. Parents then learned to provoke thought and interaction by asking opinion questions or making comments that require a comment in return, while avoiding "quizzing questions." Parents also learned to model use of target words on the device, particularly during interactions, play time or games. Parents also increased their use of different levels of prompting for responses including verbal and gestural prompts. Parents learned to provide immediate social and natural reinforcement when the child attempted and/or succeeded in producing the word or sentence targets. All participants also demonstrated an increased their use of communication targets on the iPad as well as less dependence on their parents' prompts.
Conclusions:
Full results will be presented in the poster. To-date, parents have benefitted from structured coaching on how to promote language use during interactions and activities that are motivating for their children. The individuals with autism showed prolonged engagement and use of the iPad for communication during these structured interactions. Parents also report increased use of the device for communication at home.

50 **107.050** Communicative Functions of Co-Speech Gestures during Conversation in Adults with ASD

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Background:
Co-speech hand gestures serve many communicative functions, often denoted by gesture "types." For example, gestures can be *interactive* (signaling pragmatic functions, e.g., turn taking), or *representational* (depicting physical properties of referents, e.g., shape/movement). Several studies have reported that people with ASD use the same types of gestures as controls, while others report differential proportions of certain gesture types (e.g., increased iconic/representational gestures). A further function of gesture, across types, is to present information that supplements speech (e.g., saying "the big one", while drawing a circle in the air to indicate roundness, or saying "I don't know" while gesturing toward an interlocutor, indicating their turn to speak). Some studies have shown reduced supplementary gestures in ASD, suggesting less integration across verbal and nonverbal communicative modalities.
Objectives:
Co-speech gestures in ASD have primarily been studied via elicited narratives, which offer limited opportunities for back-and-forth interaction. Gestures serve different functions based on social context, thus, the objective of the current study was to examine the communicative functions of co-speech gestures during back-and-forth interaction.
Methods:
Adults with ASD (n=24) and age-, gender, and IQ-matched typically developing controls (TDC; n=10) completed a five-trial collaborative referential communication task designed to elicit spontaneous back-and-forth conversation in a controlled setting (data on remaining 14 TDCs will be available by May 2017). We examined whether gestures fulfill different communicative functions in ASD in two ways: (1) coding gesture *types*, and (2) examining how often gestures present information that supplements speech. Gestures were coded as interactive, representational, beat (i.e., moving hands in time to speech), and other (less frequent types, including deictic/pointing).
Results:
Participants in both groups used far more representational gestures than interactives and beats (p<.001, Cohen's d=2.21), with no group by type interaction, suggesting that, on this type of task, gestures produced by adults with ASD and TDC fulfill the same communicative functions. Surprisingly, adults with ASD were *more* likely to include supplementary information in their gestures (p=.02, Cohen's d=0.91; Figure 1). Finally, we investigated whether participants in both groups modulated the supplementary information presented in gestures based on their gesture type (interactive vs. representational). All participants included more supplementary information when using interactives relative to representationals (p<.001, Cohen's d= 1.80; Figure 2) with no interaction, suggesting that adults with and without ASD are equally likely to modulate supplementary information based on gesture type.
Conclusions:
Adults with ASD use co-speech gesture to serve similar communicative functions as controls, as evidenced by comparable proportions of gesture types and equivalent patterns of modulation of supplementary information based on gesture type. Surprisingly, adults with ASD were *more* likely to include supplementary information in their gestures, which is inconsistent with previously published work on youth with ASD (e.g., Morett et al., 2016, So et al., 2014), and may reflect differences in task demands or age. Further work with the current dataset will be done to explore *how* people with ASD combine informational content from gestures and speech, and what may be driving them to include different content across communicative modalities.

51 **107.051** Conversational Dynamics in a Longitudinal Corpus of Caregiver-Child Interactions

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Background: Conversational turn-taking provides a scaffold that helps children learn the elements and rules of language (Dale & Spivey 2006, Yurofsky et al 2016). This relies heavily on social feedback and engagement (Fusaroli et al 2014), and thus conversations involving children with ASD are expected to show different turn-taking dynamics than conversations involving typically-developing (TD) children. These dynamics remain relatively unexplored.
Objectives: Our goal was to explore the turn-taking dynamics between caregivers and children with ASD. More specifically we asked: what significant differences can be observed in the number, duration, and time between conversational contributions by adult caregivers and children in dyads with ASD and TD children?
Methods: We investigated spontaneous speech in caregiver-child dyads from a longitudinal corpus (6 visits over 2 years), consisting of 30 minutes of controlled playful activities between caregivers and 67 children: 35 with ASD (MA = 33 months) and 32 initially-language-matched typically developing (TD; MA = 20 months, cf. Goodwin et al. 2012). Time-coded transcripts were used to calculate utterance duration in seconds, interturn latency (seconds between utterances), and number, and timing of each interlocutor's utterances. Mixed effects models were employed to assess the relation between diagnosis and these measures, separately in children and caregivers, controlling for participant ID, time within conversation, and visit.
Results: Â While there was no main effect of diagnosis, the conversations displayed interactions between diagnosis and time. TD children increased their turn duration over the course of a conversation more than children with ASD (Beta=-0.05, SE=0.02, p=0.003), and this difference increased in later visits (Beta=0.01, SE<0.01, p=0.007). Opposite effects were displayed in interturn latency as the children in the ASD group increased their inter-turn latency more as conversations went on than did their TD peers (Beta>-0.01, SE<0.01, p=0.037). Adults showed no differences in inter-turn latency, but those with TD children increased the length of their turns more as the children aged than adults with children with ASD did (Beta: -0.06, SE=0.02, p=0.006). Moreover, the conversations all showed interpersonal adaptation: the greater the child's latency (Beta=0.1, SE=0.02, p<0.001) and the longer their utterance duration (Beta=1.7, SE=0.01, p<0.001), the more turns per unit of time the adults took.
Conclusions: Â We used turn duration, time between turns, and number of turns per unit of time to probe conversational dynamics between adult caregivers and children with ASD. Although preliminary, our results suggest that the conversational environments in which children learn and practice their linguistic skills are also affected by ASD. Not only did the conversational contributions of children with ASD differ from those of their TD peers, the contributions of adult caregivers also differed between the group, presumably as adults adapt their conversational turns to the child they are speaking with. This highlights the importance of investigating language acquisition in children with ASD within the context of dyadic interaction.

52 **107.052** Correlates of EARLY Reading Skills in Children with ASD

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Background:
Early reading abilities, also referred to as hyperlexia, is a phenomenon that has been reported in many children with ASD (5-10%), but poorly explored.
Objectives:
to describe correlates of hyperlexia in ASD
Methods:
26 children with ASD (age 3 to 11) and early reading skills as documented by a standardized developmental reading assessment (ranging from letter recognition to text reading and comprehension), were assessed regarding global intelligence (Raven Colored Progressive Maps CPM), repetitive behaviours (Repetitive Behaviour Questionnaire RBQ) and Hypersystemiztion (Empathy Questionnaire/Systemization Questionnaire EQ-SQ)
Results:
The average age of onset of t early reading skills was 3 years. Intelligence was normal in most cases.
A fascination with letters, words and especially for logos and written classical Arabic was noted. Difficulties in non-word decoding involved visual rather than phonological reading strategies.
High scores of RBQ (Insistence on Sameness) were also noted.
A compulsive reading was noted in half of cases with high scores on hypersystemization.
Conclusions:
Hyperlexia in ASD could be a stereotyped behavior and a limited interest, related to an anticipated and regular pattern in reading (e.g. alphabet, same rules…). It is hence to be considered as an autistic feature if only limited to superficial reading ability and should be used in interventions aiming at improving social communication skills.

53 **107.053** Developing an Observational Measure of the Flexible Use of Pre-Linguistic Vocalizations in Preverbal Children with Autism

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Background: Why approximately thirty percent of children with Autism Spectrum Disorder (ASD) persist in using minimal spoken language despite intervention is unknown. Previous studies have suggested that differences in pre-linguistic skills are useful in predicting the extent to which children with ASD will develop spoken language. A foundational pre-linguistic skill that has not been investigated in children with ASD who are not using spoken language (i.e., preverbal children with ASD) is the ability to combine vocalizations with different types of affect (i.e. pre-linguistic vocalization functional flexibility).
Objectives: (1) To determine if preverbal children with ASD demonstrate the full range of vocalizations and affect evident in language-matched TD peers, and (2) To develop a measure of pre-linguistic vocalization functional flexibility (PVFF) in preverbal children with ASD to ascertain whether children with ASD are able to use vocalizations with affect flexibly.
Methods: This study used an existing longitudinal data set from The Useful Speech Project (e.g., Yoder, Watson & Lambert., 2015). The children with ASD enrolled in this study were between 20-48 months at baseline and were examined at five total measurement points separated by four month intervals. For the present study, Time 2 multimedia recordings of each child were selected during two different structured assessments with built-in communication presses: Communication and Symbolic Behavior Scales and Early Symbolic Communication Scale. A partial-interval coding scheme was used to code these multimedia recordings for the occurrence of vocalization and affect types. Vocalizations were classified in five categories based on pitch and phonation: squeal, vocant, growl, cry and laughter. Facial affect was categorized as positive, negative or neutral.
Results: The behavioral coding method developed for this study was found to be reliable for both vocalizations (Protophones: mean: 0.88 and range: 0.80-0.98) and affect (mean: 0.92 and range: 0.67-1) and stable (R= 0.97 for protophones, R=0.85 for negative affect, R= 0.85 for neutral affect, and R= 0.93 for positive affect). A significant minority demonstrated limited variety in vocalizations and affect. Six participants (30%) did not demonstrate the full range of protophones, and five participants (25%) did not demonstrate the full range of affect. PVFF was operationalized using operant contingency values (OCV) to quantify the degree of association between vocalization types and affect types. The analysis revealed predominately negative OCVs for neutral affect and protophones in this sample (i.e., vocalizations were more likely to be produced in the absence of neutral affect). OCVs for negative affect and protophones revealed predominately positive values (i.e., vocalizations were more likely to be produced with negative affect than chance).
Conclusions: The results of the analysis indicate that preverbal children with ASD demonstrate limited flexibility in their use of vocalizations with different affect. In a social communication context, this could limit the types of messages that children with ASD are sending to communication partners. If these results are replicated, PVFF could be integrated as an early target in an intervention, due to its early developmental emergence.

54 **107.054** Developmental Social Pragmatic Parent Coaching Intervention Increases Language-Promoting Utterances in Parents of Children with ASD.

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Background: Developmental Social Pragmatic (DSP) parent-coaching interventions can be effective in promoting communication skills of children with Autism Spectrum Disorder (ASD), however the specific features of such interventions that underlie developmental change are not well understood. DSP models embrace teaching functional skills in a sequence following a typical developmental trajectory, and work within natural contexts. Another component of DSP treatment models is a focus on social communication and the function of language rather than the form. Despite the known impacts of parent language functions on child language development, there is a paucity of knowledge concerning how functions of parental language may change with treatment, and how these changes might interact with language learning in children with ASD.
Objectives: To compare parent language use between a Developmental Social Pragmatic (DSP) Parent Coaching treatment group and a community treatment group, pre- and post-therapy, as a first step toward better understanding how adult language supports functional language use in children with ASD.
Methods: Forty-one parent-child dyads were randomly assigned to either a DSP treatment group (*n*=21) or waitlist, community treatment (CT) group (*n*=20). All children were between 2.0-4.11 years old at study onset and were diagnosed with ASD using the ADOS and ADI. The treatment group received 2 hours per week of DSP therapy from SLPs and OTs, while the CT group sought a variety of other forms of community based therapy (e.g. ABA, SLP, OT, Specialized Education Programs) independently, averaging 3.6 hours per week.
Twenty-five-minute parent-child interactions were videotaped pre-treatment and post-treatment, 12 months apart, and transcribed in CHILDES. The main communicative function of each parent utterance was coded by two blind coders. Six language functions were classified as either language promoting (commenting, open ended questions, responding) or non-language promoting (prompting, directing, and asking questions for which there was only one correct answer; Talbott et al., 2015). The proportion of language promoting and non-language promoting utterances was analyzed using a mixed MANOVA with follow up MANOVAs for individual functions within each category. Paired and independent t-tests examined between and within group effects.
Results: There were significant time by group interactions for both language promoting (*p*<.001) and non-language promoting utterances (*p*=.001). Analyses for individual functions indicated significant group×time interactions for directives (*p*=.008), prompts (*p*=.029), and responses (*p*=.002). The DSP parent group significantly increased their responses and decreased their directives and prompts from pre- to post-therapy, while the CT group showed no change over the year. While the groups did not differ in any function use pre-treatment, the CT group used significantly fewer responses and more directives than the DSP group post-treatment.
Conclusions: Results of this study offer support for parent-implemented interventions, suggesting that parents have the potential to apply strategies obtained from coaching in the facilitation of communication with their children. Future analysis will examine the interaction between parent and child language use.

55 **107.055** Discourse Profiles in Autism Spectrum Disorder: A Family Study of Prosody

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Background: Impairments in pragmatic (social) domains of language, including narrative and conversation, are a universal feature of autism spectrum disorder (ASD). Subtle differences in pragmatic language have been identified in a subset of parents of individuals with ASD with the broad autism phenotype (BAP; Landa et al., 1992), suggesting that familial characterization of pragmatic language may highlight genetic mechanisms underlying ASD. A crucial aspect of pragmatic language is prosody, or the intonation, stress, rate, and rhythm of speech, which is imperative for signaling communicative intent. Differences in prosody are a hallmark of the social-communicative profile of ASD, and subtler prosodic differences have been noted in first-degree relatives with the BAP (Landa et al., 1992; Losh et al., 2012).
Objectives: To use automated, objective measures of prosody alongside clinical-behavioral measures in two separate contexts to characterize prosodic profiles in ASD and in parents.
Methods: Males with ASD (n=47), their parents (n= 99), and respective control groups (n=22 male proband controls; n=46 parent controls) narrated the wordless picture book, *Frog, Where Are You?* (Mayer, 1969). Prosody was measured from recorded narrations using Praat (Boersma, 2001) to obtain mean fundamental frequency (f_0), standard deviation (SD) of f_0 and f_0 range (both measures of f_0 variability), $f_0$drop, and speaking rate. Pragmatic language was rated from semi-naturalistic conversation using the Pragmatic Rating Scale (PRS; Landa, 1992) and Pragmatic Rating Scale-School Age (PRS-SA; Landa, 2011). Acoustic variables of prosody during narration were examined in relation to pragmatic violations measured by the PRS and PRS-SA (using Principle Component Analysis) to explore how prosodic differences co-segregate with broader discourse profiles across contexts.
Results: Males with ASD demonstrated significantly different utterance-final intonation patterns, consisting of f_0 decline compared to f_0 rise identified in controls (p<.01), marginally slower speaking rate (p=.08), and increased pauses (p=.08) during narration. When prosodic features were examined in the context of broader pragmatic abilities, reserved conversational styles in males with ASD (e.g., reduced reciprocity, poor response elaboration) were associated with greater SD, range of f_0, more pauses, and slower speaking rate (p<.07). The ASD parent group did not differ from controls in features of prosody during narration; however, similar to findings in ASD, a reserved conversational style was related to increased pauses and reduced speaking rate during narration (p<.07).
Conclusions: Consistent with prior work, results indicate key areas of prosodic differences during narration in individuals with ASD and controls. Increased f_0 drop in the ASD group signals potential differences in control of the vocal mechanism to utilize varying intonation patterns, such as high-terminal rise, to highlight socially meaningful information (House, 2006). Though differences in f_0 variability were not identified between the ASD and control groups, prosodic features co-segregated with broader pragmatic styles, such that in the ASD group, those with a reserved discourse style demonstrated greater f_0 variability. Furthermore, reserved discourse styles were associated with increased pauses and reduced speaking rate in the ASD and ASD parent groups. Together, these results demonstrate that specific prosodic differences are closely related to differing broader discourse styles.

56 **107.056** Dyadic Interaction Between Bilingual Parents and Their Young Children with Autism Spectrum Disorders

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Background: Given concerns that dual-language exposure might confuse children with Autism Spectrum Disorders (ASD), bilingual parents may choose to restrict a child's exposure to a single language. The empirical evidence to date suggests no particular negative effects of dual-language exposure for children with ASD (e.g., Reetzke et al., 2015; Valicenti-McDermott et al., 2013). However, there is also evidence that some professionals advise against dual-language exposure, and suggest parents should engage the child using the community dominant language (e.g., Ijalba, 2016; Yu, 2015).
Objectives: We investigated a potential side effect of the decision to restrict parent-child interaction to community-dominant English – the possibility that parental non-native language use might alter interaction behaviours usually considered to facilitate child development.
Methods: We recruited 39 dyads – each including a child with ASD (67% boys; M_{age} = 4 years 4 months) and their parent (87% mothers) – into two groups. Around half of parents (*n*=20) were monolingual English speakers, and 19 were bilingual with English as the common non-native language. The ADOS was administered to confirm child diagnosis, and the Mullen Scales of Early Learning were used to ascertain developmental level, with children in each group matched on ADOS Calibrated Severity Score and Non-Verbal Developmental Quotient. Key measures of interest for this study concerned the parent. English language competence was assessed via a standardised measure of expressive vocabulary knowledge. Free-play interaction samples were filmed with each dyad for later coding. One sample was filmed for monolingual adults (i.e., who spoke in English) while two samples were filmed for bilingual adults (i.e., one *each* using their native language and non-native English). Immediately following each interaction sample, parents rated their comfort on 7-point Likert-type scales. Off-line, we then coded parental communicative synchrony (e.g., Hudry et al., 2013) and scaffolding of child language (e.g., Haebig et al., 2013).
Results: The parents in each group were matched on chronological age and most were tertiary-educated. Nevertheless, bilingual parents had significantly poorer non-native English-language vocabularies compared to monolingual parents. Further, during free-play interaction, bilingual parents were less communicatively synchronous with their children, used less verbal imitation of child speech, and modelled grammatically simpler language than did monolinguals. This was apparent irrespective of which language bilingual parents used, with little evidence – in this sample – of *specifically* altered interaction behaviours when using non-native English versus a native language. However, this unanticipated finding may be explained by the apparent presence of subgroups within our bilingual sample – one reporting using English during everyday interactions with their child with ASD (*n*=11), and the other reporting maintained native-language use (*n*=8).
Conclusions: These novel empirical data provide partial support for some accounts provided in previous qualitative studies of the perceived impact of bilingualism and non-native language use for parental interaction with young children with ASD (e.g., Wharton et al., 2000; Yu, 2013, 2015). With rates of both ASD diagnosis and cultural/linguistic diversity growing internationally, understanding the potential impact of language-use choices by parents and language exposure patterns for children clearly warrants further dedicated attention.

57 **107.057** Examining Expressive Language Benchmarks in Young Minimally Verbal Children

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Background: Despite accessing early intervention, up to 30% of children diagnosed with ASD are classified as nonverbal or minimally verbal at age five (Anderson, 2007). Within the minimally verbal population of children with ASD, there is high variability in both speech and language abilities, without a single identified pattern of characteristics (Tager-Flusberg & Kasari, 2013). Identifying children in this population according to characteristics of their development has important implications for guiding intervention research.
Objectives: The purpose of this study was to classify young minimally verbal children according to expressive language benchmarks proposed by Tager-Flusberg et al. (2009), and to examine the relationship between expressive language measures and autism symptom severity.
Methods: Data were analyzed from pre-intervention assessments of participants in an ongoing intervention study (HRSA grant #R40MC27707). Fifty-three minimally verbal children with autism between 36 and 54 months of age (mean age=32.6 months) participated in this study. A measure of phonology (consonant inventory) was derived from the Profiles of Early Expressive Phonology (Williams & Stoel-Gammon, 2014). Naturalistic language samples were transcribed and coded to derive measures of vocabulary (number of different words) and pragmatics (number of different communicative functions). The percentage of children in the sample who met benchmarks for each expressive language stage (i.e., pre-verbal, first words, word combinations, sentences) was then calculated for each domain (phonology, vocabulary, pragmatics). Additionally, two separate regression models examined the relationship between phonology and vocabulary with autism symptom severity as measured by the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, Dilavore, & Risi, 2008).
Results: For the domain of phonology, 43.3% of the sample met criteria for pre-verbal status (i.e., 6-12 months), 13.6% of the sample met criteria first words (12-18 months), 13.6% of the sample met criteria for word combinations (18-30 months), and 29.6% of the sample met criteria for sentences (i.e., 30-48 months). For the domain of vocabulary, 41.5% of the sample met criteria for pre-verbal status, 58.5% of the sample met criteria first words, and none of the participants met criteria for word combinations or sentences. For the domain of pragmatics, 57% of the sample met criteria for pre-verbal status, 43% of the sample met criteria first words, and none of the participants met criteria for word combinations or sentences. Separate regression analyses indicated that vocabulary and phonology were significantly related to ADOS scores, controlling for IQ (vocabulary: Beta=-.167 p=.049; phonology: Beta=-.169 p=.007).
Conclusions: While the 53 children were dispersed across all developmental phases for phonology, most children remained in early phases of vocabulary and pragmatic development. Although about half of the participants produced speech sounds at the word combination and sentence level, none of the participants met criteria for language use at higher levels. These results are reinforced by findings from the regression analyses, indicating that, on average, children with higher autism symptomology were producing fewer different words and fewer speech sounds. Future research should focus on individualizing interventions to better target specific language weaknesses highlighted in these language profiles for individuals with ASD.

58 **107.058** Examining Spoken Language in Young Children with ASD Following a 12-Week Parent-Implemented Intervention

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Background: Language develops in the context of social interaction and joint engagement (Adamson et al., 2009; Dawson, 2008; Kuhl, 2010). Therefore, interventions targeting social engagement and play for young children with autism spectrum disorder (ASD) should facilitate language outcomes (Kasari et al., 2012; Rogers et al., 2012). While some children with ASD use social information to support language learning (Luyster & Lord, 2009), social impairments often limit their opportunities for language development (Landa et al., 2011). Less attention has focused specifically on semantic development, even though language has important influences on academic outcomes and literacy (Hay et al., 2009). Thus, further research is needed to determine the impact of naturalistic developmental behavioral interventions (NDBIs; Schreibman et al., 2015) on more distal intervention targets (Wetherby et al., 2014), such as vocabulary development in young children.
Objectives: The purpose of this study is to examine 1) expressive vocabulary growth measured by the MacArthur-Bates Communicative Development Inventories (MB-CDI; Fenson et al., 2007) following a 12-week parent-implemented intervention, Project ImPACT (Ingersoll & Dvortcsak, 2010), 2) the relationship between vocabulary development on the MB-CDI and social communication measured by the Social Communication Checklist (SCC; Ingersoll & Dvortcsak, 2010), and 3) the development of vocabulary categories on the MB-CDI. A detailed approach to measuring spoken language is critical to demonstrate that results occur secondary to intervention rather than maturation.
Methods: Data are collected through a larger ongoing study of Project ImPACT. Caregiver and child outcomes are measured following 12-week groups delivered in a university clinic setting, with two to four children and their caregivers per group. Interventionists coach caregivers on strategies to support children's social engagement, language, social imitation, and play. Among other measures, caregivers complete the MB-CDI and caregivers and interventionists complete the SCC before and after program participation.
Results: Intervention groups and data collection are ongoing. Preliminary data analysis based on 10 children revealed a mean baseline of words produced of 48.57 (*SD* = 53.60). Post-intervention, mean of total words produced was 71 (*SD* = 70.1), revealing a 46.2% growth in number of words produced. Although each child demonstrated spoken language growth, wide variability across total words produced was observed and pre/post difference was not statistically significant in this small sample ($U = 18.5$; $p = .44$). Qualitative analysis of caregiver feedback indicated that 100% of parents observed growth in their children's spoken language to some degree. A Spearman Rho analysis examined the relationship between measures of vocabulary and social communication. Number of words produced was significantly correlated with the SCC play subscale ($r = .750$; $p = .05$), but not with the social or language domains. Findings on the extended sample will be presented, including visual analysis. Spoken word growth relative to specific vocabulary categories will be discussed.
Conclusions: Preliminary findings demonstrate expressive vocabulary growth following 12-week Project ImPACT with large variability. Spoken language was correlated with play skills, as suggested by previous research (Kasari et al., 2012). This study contributes to understanding of early ASD intervention on more distal intervention targets (vocabulary).

59 **107.059** Expressive Language and Social Functioning in Children with Specific Language Impairment Versus High Functioning Autism

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Background: The language phenotype of individuals with autism spectrum disorders (ASD) is heterogeneous, although most findings suggest subgroups of individuals with ASD experience language deficits. Evidence has emerged showing that cognitive and specifically, language profiles, between youth with ASD versus those with specific language impairment (SLI) are distinct. Yet, children with SLI share various social characteristics, including elevated problems with social communication and prosocial gestures.
Objectives: The purpose of this study was to characterize the language and social phenotypes in children with SLI versus high functioning autism (HFA), and to determine whether neural correlates of language processing are differentially associated with interpersonal functioning across the neurodevelopmental disorders.
Methods: Participants were 13 children with SLI, 13 with HFA, and 13 typically developing youth matched on age. The CELF-4, PPVT-3, EOWPVT, and Letter-Word Identification and Spelling subtests from the Woodcock Johnson, 3rdEdition were administered to determine functioning across language domains. The Social Responsiveness Scale (SRS) was completed by caregivers to social functioning. Participants completed MRI and DTI scans to assess for any abnormalities in neural substrates (pars opercularis, pars triangularis, superior temporal gyrus) and circuits involved in language functions (superior longitudinal fasciculus).
Results:
Multivariate analysis of variance (MANOVAs) were performed to assess between-group differences in language domains, and DTI measures (mean diffusivity, MD) and cortical thickness/area, with whole brain fiber, cortical thickness, and area as covariates respectively. Results showed group differences across CELF-4 Receptive and Expressive Language, Letter-Word Identification, and Spelling, Fs> 6.05, ps<0.01, but not receptive and expressive vocabulary knowledge (PPVT-3, EOWPVT). SLI group performed more poorly than the other two groups in CELF-4 Receptive Language and Letter-Word Identification, but comparable to those with HFA in CELF-4 Expressive Language and Spelling. Group differences were observed across SRS subscales, including Awareness, Social Cognition, Social Communication, Motivation, and Autistic Mannerisms, Fs>7.96, ps<0.001. Generally, those with HFA showed more difficulties across each subscale than TD and SLI groups, with the exception of Social Awareness and Motivation, where HFA and SLI children were comparable. No group differences were observed in cortical volume/area, and MD. Pearson correlations were computed per clinical group to assess associations between Total SRS score with language measures, and with MRI/DTI indices. No associations were observed in the TD and SLI groups. However, among children with HFA, greater social impairment was related to poorer performance on the EOWPVT and CELF-4 Receptive and Expressive Language. Additionally, among those with HFA, cortical thinning of the right superior temporal gyrus, $r(13)$=-0.70, p=0.008, and lower MD of the left superior longitudinal fasciculus to the parietal region was related to higher SRS score, $r(11)$=-0.61, p=0.04, reflecting greater social deficits.
Conclusions: In children with HFA, but not SLI or TD, social difficulties were related to their language performance, and structural abnormalities of neural substrates and circuits involved in language comprehension and visual-spatial attention. Results suggest that the etiology of the social phenotype associated with SLI versus ASD youth are likely distinct.

60 **107.060** Features of Co-Speech Hand Gestures Help Predict Diagnostic Group Membership

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Background:
Deficits in nonverbal communication are required for an autism spectrum disorder (ASD) diagnosis. Unfortunately, nonverbal communication is poorly captured by informant-based questionnaires, the standard gatekeeper of ASD screening. Thus, novel measures are needed to assess nonverbal communication, which is central to clinical decision making. During the diagnostic process, clinicians integrate developmental history, including when and how atypical behaviors manifest, with behavioral observation. Behavioral observation includes attention to both *quantitative* (e.g., how often a child makes eye contact) and *qualitative* features of behavior (e.g., how *good* was the eye contact). Questionnaires are most appropriate for measuring quantitative features of behavior, thus we sought to explore how classification of ASD vs. typically developing controls (TDCs) would improve when adding a measure well-suited for quantifying behavioral quality – specifically, features of spontaneously produced co-speech gestures.
The literature on co-speech gesture in ASD is small, but suggests that qualitative differences, e.g., in how gesture is formed, used functionally, or integrated with speech, best discriminate ASD from controls. Here we employ gesture as an example of broader differences in nonverbal communication.
Objectives:
To determine whether continuous gesture variables, including frequency, size, and amount of informational content, could predict diagnostic group membership (ASD versus TDC).
Methods:
Adults with ASD (n=24) and TDCs (n=10) were matched on chronological age, gender, and full scale IQ (see Table 1; analyses of data on 14 additional TDCs will be integrated into this presentation by May 2017). Participants completed a 20-minute referential communication task, employed through two networked laptops, designed to elicit back-and-forth conversational interaction in a controlled setting. All hand gestures produced during the task were tagged and coded by reliable coders for a variety of semantic and motor features. Three continuous variables were included in this analysis: rate, size, and amount of information in gesture. All participants completed the Social Responsiveness Scale: Self-Report (SRS-SR).
Results:
We predicted that the combination of SRS-SR, which measures frequency of social impairment and repetitive behaviors/interests in everyday contexts, and gesture variables, which measure qualitative features of behavior in vivo, would have particularly high predictive power for ASD diagnosis. Logistic regression was used to test this hypothesis. Entered as lone predictors, SRS-SR scores predicted diagnostic group membership with 82.4% accuracy (p<.001), and gesture variables predicted group membership with 85.3% accuracy (p=.005). When combined into a single model, 97.1% classification accuracy was achieved, with between 57% and 81% of the variance explained (p<.001). All participants with ASD were correctly classified, as were 9/10 TDC participants.
Conclusions:
Features of co-speech gestures are able to independently predict ASD diagnosis, and when combined with a self-report questionnaire, predictive power is very high, suggesting that these two types of measurements capture independent variance associated with ASD diagnosis. Questionnaires are an efficient measure of everyday behavior; however, no efficient proxy for behavioral observation exists. Here we demonstrate that features of co-speech gestures capture behavioral differences in ASD that are not easily measured by a questionnaire, and, that when combined with a questionnaire, can have strong predictive power for ASD diagnosis.

61 **107.061** Gesture Comprehension (GeCo) Measure Reveals Deficits in Gesture Processing in Adults with ASD

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Background: Diagnostic criteria for autism spectrum disorder (ASD) specify the presence of deficits in the understanding of gesture; however, relatively little research has examined this phenomenon, especially in adults with ASD. One eyetracking study in which gesture information could be utilized to choose which of four available referents was the target reported that the presence of co-speech gesture *facilitated* language comprehension in adolescents with typical development (TD), but *slowed* comprehension in adolescents with ASD (Silverman et al., 2010).
Objectives: The current study was designed to examine performance on a novel, ecologically valid measure of gesture comprehension in adults with ASD and TD. We hypothesized that the ASD group would show decreased comprehension.
Methods: Adults with ASD (*n* = 12) and TD (*n* = 16) completed an experimental measure of gesture comprehension, the **Ge**sture **Co**mprehension (GeCo) Task. Final sample size will be *n*=20 per group. Groups did not differ in age (ASD *M* = 23 years, TD *M* = 22), or verbal, nonverbal, or full-scale IQ (FSIQ ASD *M* = 103, TD *M* = 104; all *p*'s > 0.39). ASD diagnoses were confirmed by ADOS.
Participants watched a 35-second video of a scripted but naturalistic conversation between two young women discussing a friend's recent relocation. Immediately after watching the video, they answered 8 questions. Three questions targeted the verbal content of the video (e.g., "*When did this event happen*?"); five questions targeted information expressed only in gesture (e.g., "*What type of staircase was in Sam's new apartment*?"). A correct response to the "staircase" question required that participants integrated information from a gesture, which depicted the spiraling nature of the staircase, with the spoken conversation ("she had to climb up this huge staircase"). The verbal memory questions were designed as a metric of general motivation and attention; the gesture questions were designed to probe participant comprehension of information conveyed solely in gesture. Participants also completed the Digit Span measure of working memory capacity.
Results: Performance was compared between groups. A repeated-measures ANOVA indicated a main effect of group, $F(1,26)=12.12$, $p=0.002$, a main effect of measure (verbal memory versus gesture memory), $F(1,26)=28.11$, $p<0.001$, and a trend for a group by measure interaction, $F(1,26)=4.16$, $p=0.05$. The ASD group had significantly lower scores on gesture comprehension (ASD *M* = 52%, TD *M* =78%; $F(1,26)=0.08$, $p=0.003$); group differences for the verbal memory items did not differ (ASD *M* = 61%, TD *M* =73%; $p=0.15$). Gesture scores were not correlated with either working memory or ASD symptom severity.
Conclusions: Adults with ASD appeared to have specific difficulty integrating information from gestures, in a novel measure of gesture comprehension, the GeCo. This study extends findings of gesture comprehension deficits in ASD into adulthood. Furthermore, these deficits were apparent when viewing a brief interaction; difficulty understanding gesture is likely even more pronounced during more typical, extended, in-person interactions. This study also highlights the potential utility of the GeCo as a measure of gesture comprehension, a possibility our group will continue to explore.

62 **107.062** Gesture Development and Autism Severity in High-Risk Infants

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Background: Children with autism often demonstrate deficits in gesture use. Studying populations at increased risk for developing autism may illuminate shared or distinct pathways leading to deficits in gestures later in development. Two populations at high risk for autism are infants with fragile X syndrome (FXS; Kover & Abbeduto, 2010) and infants with an older sibling with autism (ASIB; Ozonoff et al, 2011). Given the importance of gesture use on language development, characterizing the emergence of gesture delays contrasted across high-risk populations can have important implications on earlier and more targeted intervention strategies.
Objectives: Identify the effect of autism severity on developmental trajectories of gesture use in infants with FXS and ASIBs, controlling for nonverbal abilities.
Methods: Sample included 35 males (15 FXS, 20 ASIB) recruited through an ongoing longitudinal study conducted at the University of South Carolina. We measured gesture use using the Early Gesture score on the MacArthur-Bates Communicative Development Inventories (CDI), nonverbal ability using a composite of the Visual Reception and Fine Motor domains of the Mullen Scales of Early Learning (MSEL), and autism severity using the ADOS-2 CSS. The MSEL and the CDI were collected at 9, 12 and 24 months, and the ADOS-2 was administered at 24 months.
Results: All models were time-centered at 24 months. The first growth model determined whether number and rate of gestures used differed in FXS and ASIBs. At 24 months, infants with FXS had developed about 4 less gestures than ASIBs (β=4.20, p<0.001), while the rate of gesture development did not differ between groups (β=0.05, p=0.56). When nonverbal abilities were added as a predictor in this model, results were non-significant, suggesting group differences in gesture use at 24 months may be driven by developmental delay in FXS. Next, two growth models were run to determine the relationship of autism severity on gesture use, controlling for nonverbal abilities for each group. In FXS, higher autism severity at outcome was associated with reduced gesture use at 24 months with a trend statistically (β=-0.61, SE=0.31, p=.06), but not the rate of gesture development (β=-0.02, SE=0.02, p=.34). For ASIBs, higher autism severity at outcome was associated with reduced gesture use at 24 months (β=-0.54, SE=0.23, p=.03), but not the rate of gesture development (β=-0.03, SE=0.02, p=.21).
Conclusions: Results indicated that after accounting for nonverbal abilities in FXS, ASIBs and FXS demonstrated profiles of gesture use that were similarly affected by autism severity, where autism severity was related to reduced gesture use at 24 months, but did not affect the rate at which these groups acquire gestures. These results provide evidence that early gesture use may be a shared behavioral profile across these two etiologically distinct populations, such that reduced number of gestures at 24 months in may be a similar marker for autism symptoms as it is in ASIBs. These similar patterns in gesture profiles, and the impact of autism severity on those profiles, also suggest that similar treatments may be effective in both groups.

63 **107.063** Gesturing during Conversation and Free Play in Children with ASD

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Background: Non-verbal communication has long been recognized as a core deficit in Autism Spectrum Disorder (ASD), and has recently been acknowledged as a diagnostic criterion. Gesturing, including conventional, informational, descriptive and emotional gestures, forms a main modality for non-verbal communication. Individuals with ASD have been argued to show deficits both in the overall use of gestures and, more specifically, in the use of descriptive and emotional gestures. However, research on gestures is sparse and inconclusive: whereas some point to a lifelong deficit in gesture use among individuals with ASD, others support a developmental delay that may later be diminished. Yet, most studies focus on toddlers with ASD, with little evaluation of older children.
Objectives: To compare gesturing in children with ASD to that of Typically Developing (TD) children, during a mother-child interaction. The effect of activity-type was also explored, by assessing the children with their mothers both during conversation, in which more gesturing was expected, and during free-play which was expected to elicit less gesturing.
Methods: Forty children with ASD (clinically diagnosed, and verified using ADOS-2), aged 5-10 years, and 35 typically developing (TD) controls, matched on gender and cognitive abilities, were video-recorded with their mothers during a free-play, and during a conversation. Videos were micro-coded for use of two types of gestures: conventional and descriptive. Calculated measures included total duration of gesturing, mean duration of each gesture, and onset time for initial gesturing. Levels of autistic symptoms was parent reported, using the SRS-II.
Results: As predicted, children produced longer conventional gestures, on overage, during conversation, compared to free play. This difference was not found for descriptive gestures. Compared to the ASD group, TD children spent more time performing gestures, and, on average, had longer durations for gestures. These differences were found for conversation but not for free play. Onset time for initial gesturing during conversation was shorter for the TD group, compared to the ASD group.
In the TD group, the level of autistic mannerisms was negatively associated with mean duration of conventional and of descriptive gesturing during conversation, but not during free-play. However, during free-play the mean duration of descriptive gesturing was positively associated with autism symptoms.
Conclusions: The study is among the first to investigate gesture use in older children with and without ASD. Results show the effect of activity type on gesture performance in ecological parent-child interactions. Our findings support the notion that children with ASD gesture less, use shorter, less elaborate gestures, and take longer to initiate gestures, compared to matched TD children, specifically during conversation. For TD children, it was found that gesturing less during conversation is associated with elevated autism symptoms, but also that gesturing more during free-play (instead of playing and handling toys) is related to elevated autistic symptoms. Using gestures appropriately in different contexts may be used as a marker for TD children examined for ASD, though more research on the use of gestures during conversation and free play with peers and other figures, in addition to mothers, is needed.

64 **107.064** Growth in Narrative Retelling Abilities of Higher-Functioning Children with ASD: Associations with ASD Symptomatology, Verbal Ability, and Reading Comprehension

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Background: Narrative retelling, or story memory (SM), relies on structural and pragmatic language, social cognition, and global/gist processing skills, and has been shown to pose difficulties for children with ASD (Diehl et al.,2006). These language and cognitive skills influence reading development, especially the growth of text comprehension ability (van den Broek et al., 2003). The development of reading comprehension (RC) is a significant challenge for many children with ASD (Nation et al., 2006; Ricketts et al., 2013). These challenges are so pronounced that RC impairment may be an important part of the social communication phenotype of ASD in higher-functioning children (McIntyre et al., 2016; Ricketts et al., 2013). This study was designed to examine the relations between SM, RC, language, and the social communication phenotype of school-aged children with higher-functioning ASD (HFASD).
Objectives: 1) To examine the development of SM over a 30-month period in school-aged children with HFASD using latent growth curve modeling, 2) To test the hypothesis that autism symptom severity and verbal abilities are significantly related to SM development among these children, and 3) To examine the hypothesis that SM development predicts the development of HFASD reading comprehension.
Methods: Â Participants included seventy-eight 8- to 18-year-old children with HFASD (Full-scale IQ ≥ 75). Data were collected at 3 time points across 30 months. ASD symptoms were confirmed with the ADOS-2, which provided symptom severity data. Verbal ability (VIQ) was measured by WASI-2. Narrative retelling was measured with the WRAML2 Story Memory task (SM).Â Reading comprehension (RC) was measured with the Gray Oral Reading Test-5 (GORT-5).
Results: Â The final growth model fit the data well, $\chi^2 = 8.95$ (6 df), p=0.18, CFI=0.98, RMSEA=0.08. 1) Participants varied significantly on SM intercept at T1 (SM1; M=24.99, p=0.009), but individual growth curves did not differ significantly on slope (4.2; p=0.38). 2) ADOS and VIQ both significantly related to the intercept (-1.11, p=.002;0.45, p<.001, respectively) but not slope (-0.07, p=0.77;-0.01, p=0.91, respectively) of SM growth curves. For every 1-unit increase in ADOS scores, a decrease of 1.11 units was seen in SM1; for every 1-unit increase in VIQ, an increase of 0.45 units was seen in SM1. Age was included in the model, but was not significant and was dropped as a result. 3) RC was significantly associated with the intercept (0.90, p<.001) but not the slope (-0.69, p=0.61) of SM growth curves. For every 1-unit increase in SM1, a 0.90 unit increase was seen in RC3 scores.
Conclusions: HFASD improved in their narrative retelling skills with similar 30-month growth rates regardless of initial scores. Lower ASD symptomatology and higher VIQ, but not age, were significantly associated with better SM1 performance, but did not impact growth rates. SM1 was a significant predictor of RC3, but there was no relation between the rate of SM growth and RC. These data provided unique details about the social communication development of school-aged children with HFASD, and raise the possibility that narrative retelling may be an important intervention target to improve reading comprehension in these children.

65 **107.065** High-Resolution Chromosomal Microarray Analysis in Children with Speech & Language Delay: Genetic Findings & Clinical Relevance

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Background: Chromosomal microarray analysis (CMA) is a whole-genome genetic interrogation that may identify a cause for neurodevelopmental challenges such as autism spectrum disorder (ASD), developmental delay (DD) and intellectual disabilities (ID). For this reason, CMA is recommended in medical guidelines as first-tier testing in the clinical evaluation of children with ASD, DD and ID. Because early diagnosis of ASD is critical for treatment and improved outcomes, screening methods continue to be developed and evaluated. For example, early recognition of speech & language (S&L) delay may identify children who are at risk for ASD sooner than is currently possible. S&L delay is often an early sign of a neurodevelopmental disorder in children who are eventually diagnosed with ASD.
Objectives: We wanted to determine the prevalence of genetic causes, namely copy number variants (CNVs), in children who have S&L delay as an indication for their clinical testing. We could then determine whether CNVs were associated with increased risk for ASD.
Methods: We studied the CMA results of 10,351 patients for whom CMA was ordered as part of a clinical work-up for S&L delay, ASD, DD, ID and other indications using Lineagen's FirstStep^{Dx} PLUS CMA service from 10/29/2010 through 09/30/16. T-test and chi-square analyses were used to determine whether there were significant differences in the average age at testing and detection rate, respectively, between the study groups.
Results: Our results show that children with S&L delay are being referred for genetic testing at an earlier age (~ 2 years younger) than children without S&L delay who have other testing indications. In addition, children with S&L delay have the same rate of pathogenic findings as children with other indications for testing such as ASD. Females with S&L delay have a significantly higher rate of pathogenic findings (12.8%) than males with S&L delay (7.7%). Neurologists order CMA in children with S&L delay more often than other specialists or pediatricians. Comparison of the most common genetic diagnoses shows that the causes of S&L delay vs. other indications are different and that there are important changes in clinical management associated with these genetic disorders.
Conclusions: Children with S&L delay often have an identifiable genetic cause for their clinical challenges. The rate of abnormal genetic findings is the same or greater than in children with other guideline recommended clinical indications (ex: ASD). We do not know whether children with S&L delay who were referred for testing went on to develop ASD. However, this study is important because it suggests that CMA, which can be done at any age upon recognition of S&L delay, may offer objective information that leads to earlier identification of ASD than is currently possible. These findings underscore the importance of CMA as soon as risk factors or developmental delays are identified.

66 **107.066** Higher Maternal Autism Spectrum Quotient Score Predicts Weaker Tendency to See Pragmatic Impairments As a Problem

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Background: Â Individuals with autism spectrum disorder (ASD) show deficits in reciprocal social interactions and impairment in verbal communication, such as difficulties in understanding humor, irony and sarcasm (Frith, 2003). Sucksmith et al.'s (2011) review of work on the Broader Autism Phenotype states that many studies on the language domain of autistic atypicalities have suggested that the parents and siblings of autistic probands have significantly greater difficulty using language to communicate for social purposes (pragmatics) compared to controls. Komeda et al. (2015) conclude that both individuals with ASD and those with typical development (TD) make selective neural responses toward people who are similar to themselves, although there are differences in the neural mechanisms between ASD and TD. We hypothesized that individuals with higher Autism Spectrum Quotient (AQ) scores are permissive to others with pragmatic language impairments.
Objectives: Â The purpose of this study was to investigate the correlation between maternal AQ score and mothers' evaluation of pragmatic impairments in children.
Methods: Â Participants were selected from 100 mothers who were randomized according to sample allocation from over 800,000 questionnaire respondents by a marketing research corporation in Japan. We applied sample allocation to choose eight or nine mothers of children of each sex in each grade from grades 1 to 6. Mothers' mean age was 40.3 years (standard deviation = 5.3, range = 26-55). AQ and scales D to H (D. coherence, E. inappropriate initiation, F. stereotyped language, G. use of context and H. nonverbal communication) of the Maternal Evaluation of Pragmatic Impairments in Children (MEPC) from the Children's Communication Checklist Second Edition (CCC-2), which measures pragmatic impairments, were administered through an Internet survey. Using MEPC, mothers were asked to estimate how they would feel if their children showed the communication behaviors listed in scales D to H with responses given on a five-point Likert scale from "1. It isn't a problem" to "5.Â It's a problem ."
Results: Â Data were analyzed using Pearson's correlation coefficients and regression analysis. There was a significant negative correlation between maternal AQ scores and MEPC scores ($r=-0.2577$, $p<0.01$). We also found significant negative correlations for each of the communication and imagination subscales of AQ and scores for subscales D to H of MEPC ($p<0.05-0.001$) (see Table 1). There was no correlation between the other AQ subscales including social skills, attention switching and attention to detail and any of the scores for subscales D to H of MPEC.
Conclusions: Â Higher maternal AQ score predicts mothers being more permissive to pragmatic impairments. This study showed correlations between the communication and imagination subscales of AQ and the evaluation scores of pragmatic impairments in CCC-2. However, no correlations were found between the other AQ subscales and the evaluation score of pragmatic impairments in CCC-2.

67 **107.067** Human References: What the Words That Adolescents with ASD Use Reveal about the ASD Phenotype

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Background:
Deficits in verbal communication are evident in varying degrees in individuals with Autism Spectrum Disorder (ASD). Research has documented a host of language symptoms, including idiosyncratic and/or repetitive speech, uneven language development and difficulty with pragmatic aspects of language including aberrant vocal quality, tone, and/or volume. However, we know little about the words used by those with ASD, and how they may differ from those of their neurotypical peers.
Objectives:
This study investigated the ways in which adolescents with ASD (Adol_ASD) use words compared to their neurotypical (Adol_NT) peers.
Methods:
Nineteen Adol_ASD and 14 Adol_NT participants (11-21 years, all male) were enrolled in the study. Participants in the two groups were comparable in chronological ($F(1,31)=1.56$, $p=.22$) and mental age ($F(1,31)=.19$, $p=.67$). The Autism Diagnostic Observation Schedule (ADOS; Lord et. al., 1989) was used to confirm ASD diagnosis. The ADOS was transcribed from video. Transcriptions were analyzed using the Linguistic Inquiry and Word Count program (Pennebaker, Booth, Boyd, & Francis, 2015), yielding information on participant word use across approximately 90 variables. Our analyses focused on variables within three categories: (1) Interpersonal Referents, (2) Internal State Referents and (3) Ambiguous Action Referents.
Results:
Oneway ANOVAs were conducted to compare the LIWC variables between the Adol_ASD and Adol_NT groups (see Table 1). Overall, Adol_ASD participants focused more on themselves (I-words), and used fewer words referring to others (e.g., 3rdperson pronouns) including broad classes of people, events, and actions (interrogatives) compared to Adol_NT participants. Interestingly, the language patterns of the Adol_ASDs suggested they spoke in an interpersonal manner consistent with having lower social status or clout. In terms of Internal State Referents, Adol_ASD use fewer words reflecting feelings, biological or bodily processes, and emotional states, such as anxiety. Finally, Adol_ASD participants more frequently referred to ambiguous action and objects than Adol_NTs.
Conclusions:
The current study provides insight into phenotypic language use in ASD. Our findings suggest that Adol_ASD use words reflecting greater self-focus (e.g., "I"). Further, when Adol_ASD make reference to others, they more often use non-specific impersonal pronouns, and ambiguous referents such as "who", "what", and "where" (interrogatives). Results suggest that adolescents with ASD rely on action words (verbs, auxiliary verbs) and more often employ value-laden references such as "should", "would", and "could" (discrepancy words) when describing events and objects.Â Results reveal that Adol_ASD make less frequent references to human internal states (e.g., anxiety, feelings, biological and body processes). Finally, results suggest that the linguistic profiles of Adol_ASD reflect less clout - or influence – than those of Adol-NT. Interestingly, individuals with high clout more often use "we" and less often use "I."Â They also use more social words and fewer negations. Taken together, this pattern of word use conveys as more confident and influential.Â In sum, our study revealed that adolescents with ASD may engage in patterns of word use reflecting greater self-focus, less awareness of internal states and, also, may be perceived as less influential. These findings may have implications for life skills training programs for individuals with ASD.

68 **107.068** Identifying Endophenotypes in Autism Spectrum Disorder and Fragile X Syndrome: A Multi-Method Approach

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Background: Fragile X syndrome (FXS), caused by a mutation of the *FMR1* gene, is the most common single-gene disorder associated with autism spectrum disorder (ASD), with up to 75% of males with FXS meeting diagnostic criteria for ASD (FXS-ASD; Klusek et al., 2014). However, in-depth studies of specific phenotypic domains in idiopathic ASD (ASD-O) and FXS suggest that while substantial overlap may exist in the social-communicative domain (Klusek et al., 2014, Losh et al., 2012), the expression of restricted and repetitive behaviors (RRB) is more distinct (Wolff et al., 2012), suggesting that *FMR1* variation may play a role in selected ASD phenotypes. To address this question, this study directly compared profiles of social communication and RRBs in individuals with FXS-ASD, FXS without ASD (FXS-O), and ASD-O, applying multiple measures of symptoms in both domains.
Objectives: To characterize social communication and restricted and repetitive behaviors in idiopathic ASD and individuals with FXS with and without ASD using a multi-method approach.
Methods: Eighty-four males with ASD-O, 55 males with FXS-ASD, and 16 males with FXS-O were included. The Pragmatic Rating Scale-School Age (PRS-SA; Landa, 2011) and the communication and social items of the Autism Diagnostic Interview-Revised (ADI-R) were used to evaluate social communication. RRBs were assessed using the ADI-R RRB items and the Repetitive Behavior Scale-Revised (RBS-R). Principle Component Analyses were conducted to determine the factor structure of phenotypic profiles across FXS and ASD. Correlations were examined with *FMR1*-molecular variation, including CGG repeat length and levels of FMRP.
Results: On detailed clinical-behavioral ratings of pragmatic language (i.e., PRS-SA), individuals with ASD-O and FXS-ASD did not differ, and demonstrated significantly greater rates of impairment in domains of conversational reciprocity, redundancy, and disinhibition compared to males with FXS-O (ps<.05). For parent-reported difficulties in communication (ADI-R) a stepwise pattern emerged in which males with ASD-O demonstrated the greatest impairment, followed by males with FXS-ASD and then males with FXS-O (ps<.05). In contrast, on both the ADI-R and RBS-R, males with ASD-O demonstrated distinct profiles of RRBs, including significantly greater rates of behaviors associated with insistence on sameness, sensory interests and aversions, compulsions, and self-injury compared to males with FXS-ASD and FXS-O (ps<.05). Additionally, males with FXS-ASD demonstrated greater impairments in sensory seeking and aversive behaviors than those with FXS-O. Variation in *FMR1* expression was related to greater impairments in social communication in all three groups, and greater rates of repetitive sensorimotor behaviors in FXS-O (ps<.05).
Conclusions: Findings confirmed substantial overlap between ASD and FXS-ASD in the social-communicative domain, and revealed significant relationships between social communication and *FMR1*-related variation. In contrast, distinct profiles of RRBs were observed, indicating syndrome-specific areas of difficulty that are impacted by increased ASD symptomatology in FXS. Together, findings suggest that social communication impairments may constitute an important overlapping endophenotype in ASD and FXS, which may be used to clarify the complex etiology of ASD.

69 **107.069** Identifying Factors That Predict, Moderate and Mediate Alternative and Augmentative Communication (AAC) Outcomes for Preschool Children with Autism

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Background: Clinicians must consider numerous factors when prescribing Augmentative and Alternative Communication (AAC) for children with autism, including the children's individual learning profiles, families' preferences, and resource constraints. Furthermore, when considering the research evidence, documented variability in AAC intervention outcomes in research makes it hard for clinicians to select the intervention most likely to be effective for a given individual. The aim of this study was to identify child-related factors associated with AAC intervention outcomes for children with autism through a systematic review of the research literature.
Objectives: N/A
Methods: A systematic search was completed of peer-reviewed research articles presenting studies in which AAC intervention outcomes, and factors associated with these, were reported for children with autism and/or developmental disability. The following data were extracted: (a) participants, (b) AAC intervention/s, (c) communication outcomes, (d) baseline child characteristics, and (f) social environmental factors.
Results: The search yielded 965 titles and abstracts, of which seven articles relating to 7 studies met criteria for inclusion. Child characteristics associated with communication outcomes were pre-intervention cognition, autism severity, communication competence, verbal imitation, vocabulary comprehension, object use, joint attention, and language use.
Conclusions: The findings point to the need for further research to better understand the nature of the association between these factors and outcomes, as well as the potential for these factors to assist in matching children with interventions most likely to meet their individual needs.

70 **107.070** Illuminating the Role of Association and Spatio-Temporal Location for Word Learning in ASD

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Background:
Research suggests that children with Autism Spectrum Disorder (ASD) learn words from association (e.g. Akechi et al., 2011; Baron-Cohen, Baldwin & Crowson, 1997; Preissler & Carey, 2005). However, these findings may reflect cognitive delay rather than autism per se; and the associational binding between a word may more simply refer to spatio-temporal position or the nature of the symbolic reference by which attention is drawn.Â Little research to date has compared the influence of different symbolic cues to prompt the child to the link between a spoken word and its intended referent.
Objectives:
The three objectives of the research were: to examine the nature of association in word learning within a group of children with ASD with varying verbal mental age (VMA), comparing different symbolic gestures (an arrow, illumination of the object, both, or both but identifying different objects); to investigate the effect of spatio-temporal location on children's word-object mappings; and to tease apart the effects of intellectual disability and autism, by comparing children with ASD to children with intellectual disabilities (ID) and a typically developing (TD) cohort.
Methods:
Children (*N*s: TD = 32; ASD = 31; ID = 22) watched a video of a speaker labelling novel objects. One referent was presented with a cue highlighting attention (i.e. arrow next to the object, light illuminating the object, or arrow and light concurrently presented) as the speaker uttered a novel word. After the video, children were asked to indicate the target referent. On half the trials, the position of the objects was reversed.
Results:
The findings are depicted in Figure 1 and Table 1.
· As would be expected, when the arrow and illumination (light) conflicted children in all three groups were at chance.
· The arrow cue, presented alone or with illumination, enabled children with ASD to perform above chance in learning a new word.
· Word learning occurred when the objects remained in position and when they were reversed.
· (not shown in Table 1 or Figure 1) children with ASD with a higher VMA (mean of six-years-old) tended to perform better than those with a lower VMA (mean of three-years-old), particularly for the arrow trials and reversed position trials
Conclusions:
Word learning in ASD is not simply an association between a word and a place – it refers to the object being labelled.Â We also found that word learning is influenced differentially by the cue which accompanies a label. Children with ASD learn words from arrows but not object illumination and originally only map object labels to particular spatial locations. The three populations showed differences in word learning from the cues relative to each other (see Figure 1). These results emphasise the importance of studying different types of associative cue, a varying VMA range of children and including children with ID as controls in ASD research. Further analysis of these influences might provide insights into how children in various groups grasp word-referent connections.

71 **107.071** Imagining Counterfactual Worlds in Autism Spectrum Disorder

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Background:
Counterfactual reasoning is an important part of social communication and may be a necessary precondition for development of Theory of Mind. Counterfactual reasoning relies on both imaginative and inhibitory processes, both of which may be impaired in people with Autism Spectrum Disorders (ASD). Limited previous research has found counterfactual reasoning ability to be impaired in *children* with ASD, but this has never been explored in *adults*. Past research has also relied on the generation of counterfactual statements or responses to counterfactual reasoning questions, which create ambiguous task demands for people with ASD. Exploring counterfactual reasoning ability with online processing measures eliminates this potential confound.
Objectives:
We present four eye-tracking experiments (experiments 1 and 2 complete; approximately 50% of data collected for 3 and 4) that explore the processing of counterfactual sentences, requiring differing levels of inhibition and imagination, in individuals with ASD and typically developing (TD) participants in an anomaly detection reading task.
Methods:
Experiment 1 depicted everyday events that incur a minimal change from reality (e.g. "If Joanne had remembered her umbrella, her hair would have been dry/wet…"). Experiment 2 described alternative versions of known historical events that require readers to suspend their knowledge of reality and imagine a novel version of the world (e.g. "If Spain were not a member of the European Union, they would pay for things using Pesetas/Euros…"). Experiment 3 presented completely novel scenarios requiring a high degree of imagination (e.g. "If margarine contained soap, mum could use margarine in her washing/baking…"). Experiment 4 explored the processing of counterfactual sentences within well-known fictional worlds (e.g. "If Harry Potter lost his magic powers, he would use his broom to sweep/fly…"). Factual contexts ("Because…") provided a baseline measure of contextual integration.
Results:
Results from Experiments 1 and 2 (*n*=50) revealed similar comprehension strategies for TD and ASD groups (faster counterfactual inconsistency-detection in Experiment 2 than 1). However, relative to controls, participants with ASD were *faster* to detect the factual inconsistency in Experiment 1, and were more likely to regress back to aid comprehension of a counterfactual world in Experiment 2.
Preliminary results suggest similar findings for Experiments 3 and 4 (*n*=20). For example, in Experiment 3, adults with ASD demonstrated typical counterfactual processing with faster detection of anomalies within factual than counterfactual sentences, with some evidence suggesting slower counterfactual processing in Experiment 4.
Conclusions:
Overall, our results across experiments (and two different samples) suggest that adults with ASD are well-able to process counterfactual sentences and do so in a similar time course to TD adults, even when these sentences place demands on imagination and inhibition. This implies that difficulties with Theory of Mind in adults with ASD are not the result of counterfactual processing deficits. However, some subtle between group differences were found when counterfactual processing required inhibitory control. Adults with ASD appeared slower to process counterfactual scenarios requiring inhibition of prior knowledge (whether factual e.g. the Titanic sinking, or fictional e.g. that mermaids have tails). The theoretical and clinical implications of this will be discussed.

72 **107.072** Impaired Resolution of Ambiguous Homographs in High-Functioning Individuals with Autism: An ERP Study

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Background: Â Autism spectrum disorders (ASDs) are partly characterized by deficits in communication and pragmatic language, particularly in determining the meaning of ambiguous words in context. For example, when reading sentences aloud, individuals with ASD are more likely than individuals with typical development (TD) to mispronounce ambiguous homographs like “lead” and “tear”. Traditionally this difficulty has been interpreted within the “weak-central coherence” theory of autism, which suggests that individuals with ASD have impaired contextual integration. However, difficulty with correctly reading homographs could also stem from executive control deficits, such that individuals with ASD have difficulty inhibiting the context-inappropriate meaning of the homograph.
Objectives: Â We used the N400 event-related potential (ERP) to tease apart executive control and context sensitivity processes in individuals with ASD. Using sentence stimuli designed to distinguish between context sensitivity and executive control, we compared N400 responses to lexical ambiguity and semantic incongruity in ASD and TD groups. If impairments in ambiguity resolution in the ASD group result from difficulty attending to contextual clues, then these impairments should correlate with a reduced N400 to incongruous words. Conversely, a dissociation between these two mechanisms would suggest that individuals with ASD have a specific impairment in disambiguating meaning.
Methods: Â Twenty adults with ASD and 20 matched TD adults (ages 18-68) read 120 sentences for comprehension, responding to relatedness probes after each sentence. Materials consisted of sets of four sentences, adapted from Sitnikova et al. (2002). All sentences had a first clause that biased either the dominant or subordinate meaning of a homograph. A second clause contained a target word associated with the homograph’s dominant meaning. Finally, a control word at the end of the sentence was either congruent or incongruent with the preceding sentence context. Sentences were presented in rapid serial visual presentation (RSVP) format during concurrent EEG recording.
Results: Analyses were performed at nine regions across the scalp (representing frontal, central, and parietal sites and left, midline, and right lateralities). Repeated-measure ANOVAs were run with factors of congruity (congruent/incongruent), site (frontal/central/parietal), laterality (left/midline/right), and group (ASD/TD). At the control word, both groups showed a significant N400 effect from 300-500 ms over central and parietal scalp. The magnitude and topography of the N400 effects were comparable between groups. At the target word, the TD group showed a small N400 effect from 350-450 ms over the right hemisphere. In contrast, the ASD group did not show a significant N400 effect in response to the target word.
Conclusions: Both groups showed an N400 effect in response to control words, indicating that the ASD group effectively attended to sentence context. In contrast, the ASD group showed no N400 effect to the target words, indicating inappropriate ambiguity resolution. The dissociation between these two effects suggests that inattention to context is an unlikely explanation for the disambiguation deficits in the ASD group. Instead, atypical ambiguity resolution may result from inappropriate executive control mechanisms, such that individuals with ASD are unable to suppress the context-inappropriate meaning of the homograph.

73 **107.073** Individuals with 16p11.2 Deletions Show Aberrant Feedback Processing during Speaking

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Background: The specific types of deficits in the sub-processes necessary for speaking are poorly understood in children with Autism Spectrum Disorder (ASD) and 16p11.2 deletions. Given the highly penetrant speech production deficits in children with 16p11.2 deletions, examination of speech sub-processes in this group offers an opportunity to identify discrete points of dysfunction in the speech production system. In particular, a better understanding of the role of auditory feedback in the control of speaking in these participants could potentially lead to insights into novel targets for intervention and directions for therapeutic treatments.
Objectives: To examine the impact of auditory feedback processing on speech production in participants with 16p11.2 deletion compared to sibling controls.
Methods: Two tests of sensitivity to auditory feedback during speech were collected from 12 participants with 16p11.2 deletion and six sibling control participants. The first test, called a pitch perturbation test, examined how subjects quickly changed the pitch of their voice within a trial to correct for a brief perturbation of their auditory feedback, a response known as “pitch feedback compensation”. The second test, called a speech formant adaptation test, examined how, over many trials, subjects learned to adapt to sustained vowel identity changes in their auditory feedback during vowel production.
Results: Results indicated that 16p11.2 deletion carriers showed an exaggerated pitch compensation response to unpredictable mid-vocalization pitch perturbations compared to sibling controls, $t(7.45)=2.54$, $p=.037$). In contrast, they showed reduced adaptation to sustained vowel identity changes in auditory feedback, ($t(12)=3.04$, $p=.010$).
Conclusions: The overcompensation response to unpredictable online auditory feedback alterations demonstrated in our participants with 16p11.2 deletion is similar to what has been observed in a subset of participants with idiopathic ASD. Our data also showed reduced speech sensorimotor adaptation following consecutive trials in which the vowel identity of auditory feedback was altered in a predictable way. A reduced adaptation response has been reported in typically developing younger children and to an even greater extent in toddlers, which may suggest a maturational dysfunction of one or more speech production mechanisms in participants with 16p11.2 deletion. This reduced speech adaptation in the context of the strong compensation response during the pitch perturbation task means that while deletion carriers were able to detect and make some effort at correcting perceived speech errors in real time, they failed to change their speech model in anticipation of highly predictable alterations in auditory feedback.

74 **107.074** Investigating Relationships Between Linguistic and Pictorial Symbolic Domains in Children with Autism Spectrum Disorder and Typical Development

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Background:
If children are to become effective communicators, it is vital that they learn to comprehend and produce linguistic and pictorial symbols. For typically developing (TD) children, early understanding of pictures is scaffolded by their superior and early-emerging understanding of language. However, autism spectrum disorder (ASD) is often characterised by severe and prolonged language impairments, and recent evidence shows that minimally verbal individuals also have an atypical understanding of pictures. Here, we explore the possibility that deficits in linguistic and pictorial domains are causally related in ASD.
Objectives:
For the first time, this study modelled concurrent predictive relationships between comprehension and production of language and pictures (plus non-verbal intelligence, chronological age, and autism severity) in linguistically-delayed children with ASD and TD controls.
Methods:
Participants were 30 children with ASD (*M* age = 11;4) and 24 TD children (*M* age = 4;5). The Mullen Scales of Early Learning measured language comprehension (ASD: *M* = 3;7; TD: *M* = 4;5) and language production (ASD: *M* = 3;4 ; TD: *M* = 4;8). The Leiter-R measured non-verbal intelligence (ASD: *M* score = 63.5; TD: *M* score = 50.46) and the Childhood Autism Rating Scale measured autism severity (ASD: *M* score = 36.93; TD: *M* score = 15.42). Picture comprehension was assessed by asking children to identify the 3-D referents of line drawings. Picture production was assessed by asking children to draw unfamiliar 3-D objects and having independent raters identify their referents. Predictive relationships between domains were modelled via hierarchical regressions.
Results:
For children with ASD, pictorial understanding was predicted by language abilities (β = .41-.64, p = .03-.001), and autism severity (β = -.45, p = .02). Language comprehension and production predicted each other (β= .65-.85, $p < .001$), and the latter was also predicted by autism severity (β = -.22, $p = .02$). For TD children, picture comprehension was predicted by language abilities (β = .38-.42, $p = .045$-.05), which in turn were predicted by non-verbal intelligence and chronological age (β = .34-.48, $p = .04$-.02). Comparisons between subgroups ($N = 16$ per population) matched on language comprehension and production revealed no differences in pictorial understanding. However, when matched on non-verbal intelligence, children with ASD showed significantly reduced pictorial understanding relative to TD peers ($t = 5.2$-32.3, $p = .03$-<.001).
Conclusions:
As in typical development, pictorial understanding in ASD is scaffolded by language. This between-domain relationship is similar to that observed in young TD children, and aligns with Vygotskian social-cultural theories of development rather than domain-specific theories. The observed predictive relationships indicate that referential language impairments may elicit downstream deficits in picture comprehension and production. Consequently, children with severely impaired language may not understand the representational nature of pictures. From an applied perspective, this has important implications for children's learning and usage of picture-based communication interventions. However, improving language through targeted interventions may elicit advances in understanding across multiple symbol systems.

75 **107.075** Is Autism Left-Handed? Exploring Abnormal Lateralization in Handedness and Language Among Individuals with ASD.

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Background: Language and fine-motor function are typically lateralized to the left hemisphere. Neurologic lateralization during brain development underlies handedness and communication asymmetry. Atypical lateralization of these functions has been observed in individuals with autism spectrum disorder (ASD) and other neurodevelopmental disorders. Recently, a study of handedness in individuals with ASD reported a lower handedness score than typically developing (TD) children. Limited research has suggested a small effect of handedness on language, in that right-handed children had better language scores than non-right-handed subjects.
Objectives: The current study aims to explore the difference in handedness quotient between individuals with ASD vs. TD. In addition, this study investigates the association between handedness and language function among individuals with ASD. Finally, the association between handedness and communication is explored separately for different facets of a handedness assessment. Handedness is measured utilizing the Edinburgh inventory, which measures the degree of dominance of an individual's right or left hand based on eye, hand and foot laterality.
Methods: Â Thirty children diagnosed with ASD and seventeen TD children ages 8-18 years old underwent testing for handedness utilizing the Edinburgh Handedness Laterality quotient. Communicative function was assessed with the Vineland Adaptive Behavior Scales – Second Edition, Communication Domain (VABS-CD). Linear regression analysis was performed to explore the correlation between Edinburgh handedness quotient and communication scores. A t-test comparison of VABS-CD communication scores between right-handed and left handed and ambidextrous/undifferentiated individuals with ASD was completed for each item in the Edinburgh scale as well as global Laterality Quotient.
Results: Â The difference in handedness quotient between individuals with ASD (median 88) and TD (median 100) did not reach significance (p=0.319). There is no significant correlation between handedness quotient and VABS-CD scores (r^2=0.1, p=0.109) Furthermore, there was no significant difference between VABS-CD communication scores among individuals with ASD who are right-handed vs. those that are left handed and ambidextrous/ undifferentiated (p=0.702). No differences emerged even when communication scores were compared based on laterality of each item on Edinburgh handedness quotient scale (lowest p-value was 0.201).
Conclusions: This study failed to replicate the reported association between handedness and communication function among individuals with ASD. Studies controlling for non-verbal intellectual quotient are necessary to explore whether individual differences in cognition may account for discrepant results. Further studies investigating the inter-relation between abnormal lateralization of communication and motor function may inform the neurobiologic basis of autism and other neurodevelopmental disorders.

76 **107.076** Joint Attention at 22 Months As a Predictor of Communication Skills in Preschool

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Background: Early joint attention (JA) skills are known to predict later language skills in children with ASD (Charman, 2003; Poon et al., 2012). However, little is known about the extent to which these skills may be variably related to general language outcomes versus more pragmatic aspects of language use. We aimed to address this gap in the literature via analyses using a sample of children (n=46) who were identified as at-risk for ASD at 12 months of age using a community screener (FYI; Baranek et al., 2003). Specifically, we sought to examine the extent to which general language outcomes versus pragmatic language outcomes at preschool age were predicted by JA skills at 22 months.
Objectives: Our aim was to determine if JA skills at 22 months variably predict general language outcomes versus pragmatic aspects of communicative competence, specifically reciprocity, initiation, and topic maintenance during conversations and narrative retell ability.
Methods: Items on the ADOS Module 1 targeting JA skills (Showing, RJI, and Spontaneous IJA) collected at 20-24 months (m=22, sd=.8) were used in regression models to predict general language skills on the Preschool Language Scales-5th Edition (PLS-5; Zimmerman et al., 2011). Next, JA skills at 22 months were used to predict specific pragmatic skills on the Pragmatic Rating Scales-School Age (PRS-SA; Landa, 2011; Reciprocity, Initiation, and Topic Maintenance), and narrative retell abilities using the Narrative Scoring Scheme (NSS; Heilmann et al., 2010) for a sub-sample of 4-5 year olds (m=59.72 months, sd=6.7), whose language levels were advanced enough to code using the PRS-SA.
Results: In this sample of children identified at 12 months as at-risk for ASD, the three items targeting JA on the ADOS at 22 months accounted for a significant amount of the variance in Expressive Communication (R^2= .21, p=.02) but not Auditory Comprehension on the PLS-5 (R^2=13.98, p=.09) in preschool. RJA was the only significant predictor of Expressive Communication, accounting for most of the variance in preschool expressive language skills. None of the JA items were significant predictors of Reciprocity or Initiation on the PRS-SA, but JA items at 22 months accounted for significant amounts of variance in PRS-SA Topic Maintenance (R^2=.34, p=.03) and total narrative retell skills on the NSS (R^2=.31, p=.02) in preschool. Showing (p=.06) and RJA (p=.06) were the biggest contributors of variance in Topic Maintenance, while Showing (p=.01) was the only significant predictor of narrative retell. The contributions of the JA items in all of these models accounted for significant variance above and beyond the ADOS total algorithm score, which was not a significant predictor in any of the models.
Conclusions: In this at-risk sample, JA skills at 22 months significantly predicted expressive language ability in preschool. However, early JA skills accounted for a larger amount of variance in the children's maintenance of another person's topic and narrative retell ability than they did in general expressive language skills at preschool age. Findings support the importance of interventions targeting JA skills in toddlers at-risk for ASD to improve later pragmatic functioning.

77 **107.077** Language Acquisition and Communicative Development in Mandarin-Learning Preschool Children with ASD: Assessment Via the Pcdi-Infant Form

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Background: English-learning preschool children with autism spectrum disorders (ASD) have often been reported to demonstrate the severe delay of receptive and expressive vocabulary and non-verbal communication, functional object use and play skills (Charman *et al*., 2003; Luyster *et al*., 2007). Recent research has begun to delineate expressive language profiles in Mandarin-learning children with ASD (Su *et al*., 2016). However, little is known about both receptive and expressive, and non-verbal language profiles of Mandarin-learning preschool children with ASD.
Objectives: Using the Putonghua Communicative Development Inventory: Words and Gestures (PCDI-Infant Form; Tardif *et al*., 2008), this study attempts to investigate the early development of understanding of phrases, words comprehension and expression, and production of gestures in Mandarin-learning preschool children with ASD.
Methods: Parents of 75 2-6-year-old children with ASD (66 boys and 9 girls, mean age=54.52±14.40 months) completed the PCDI-Infant Form. Language and communicative abilities were compared with the published norms of typically-developing (TD) infants and the published patterns of English-learning preschool children with ASD respectively.
Results: Â (1) Compared with the published norms of TD infants, the results indicated that Mandarin-learning preschool children with ASD demonstrated the following differences: ①The serious delay in early language development (in domains including First Signs of Understanding, Phrases, Starting to Talk, Vocabulary, Actions and Gestures); ②The considerable variability in language acquisition; ③For the "Vocabulary" part, their impairments of receptive language seemed to be severer than expressive language; ④In the gestural domain, their early gestures (12/27 points) were more impaired than late gestures (17/27 points); ⑤For correlations, results showed an overall significant correlation even with age partialled out (*p*s<.001). There were also strong correlations between vocabulary production and gesture production (r=.537 and r=.542 respectively, both *p*s<.001), and phrases understood (r=.574 and r=.574 respectively, both *ps*<.001), while both showed weak correlations in the published norms of TD infants (r=.41, *p*<.05 and r=.29, *p*>.05 respectively). (2) Compared with English-learning preschool children with ASD, the results indicated the similar developmental patterns: ①The serious delay in early language acquisition and communicative development were demonstrated across languages; ②Gesture production acting as a "bridge" between language comprehension and language production, as these three domains were significantly correlated with each other (*p*s<.001); ③When the participants were divided into 3 age subgroups (2-3-year-olds, 4-year-olds, 5-year-olds and above), results showed insignificant difference of age between the subcategories of the PCDI-Infant Form (*p*s>.05), different from the results of English studies.
Conclusions: Mandarin-learning preschool children with ASD have demonstrated sever impairments in both receptive and expressive, and non-verbal language development. The serious delay compared with the published norms of TD infants highlighted the importance of timely and effective language intervention. While compared with English-learning preschool children with ASD, the patterns of early language acquisition and communicative development demonstrated similarities across languages. Additionally, we conjectured that the reason of no apparent age effect may result from the severer impairments in Mandarin-Learning preschool children with ASD. These findings in general corroborate the early language and communication profiles reported in English-learning preschool children with ASD.

78 **107.078** Language Assessment in Minimally Verbal Children with ASD

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Background: Language and communication impairments are common in children with ASD and are particularly salient in minimally verbal (MV) children. There is heterogeneity in language ability even among MV children, and there is still a lack of consensus in the way MV status is defined. As MV status is inherently shaped by the language assessments used with these children, understanding the methods and measures by which language is assessed with this population is one step toward constructing a clear definition of what it means for a child to be "minimally verbal." Additionally, understanding concurrent predictors of language in this population may help inform both research and clinical practice.
Objectives: We present data exploring associations between receptive language (RL) and expressive language (EL) scores from different assessments and examine concurrent predictors of language skills in minimally verbal children.
Methods: Children (n=294) participated in multisite studies targeting social communication in MV preschool and school-aged children. The language measures used in the present study were collected as baseline measures for the original studies. The assessments analyzed were: Mullen Scales of Early Learning, Reynell Developmental Language Scales, Peabody Picture Vocabulary Test, Test of Early Language Development, Vineland Adaptive Behavior Scales and the MacArthur-Bates Communicative Development Inventories: Words and Gestures, and a naturalistic language sample. Concurrent predictors of language ability (using RL and EL composites) analyzed included child's imitation ability, response and initiation of joint attention (JA), symbolic play, non-verbal cognitive ability, and chronological age.
Results: Using Spearman's partial rank correlations controlling for age we found the correlations between EL raw scores to be moderate to strong and all significant at the 0.01, while RL raw scores were strongly correlated at the 0.01 level. We conducted discrepancy analyses using Friedman's test and found that the age equivalents across EL and RL measures were significantly different. Regression models were used to predict concurrent expressive and receptive language. The results indicate that imitation (t=2.26, p=.025) and initiation of JA (t=3.94, p< .001) were significant predictors of concurrent RL (R^2=.20). Additionally, imitation (t=2.51, p=.013), initiation of JA (t=2.38, p=.018), and nonverbal cognitive ability (t=3.35, p<.001) predicted EL (R^2=.25).
Conclusions: Results indicate that there was strong convergent validity in raw scores for EL and RL measures, but the age equivalents produced were different. These findings demonstrate that there are different measures that can be used to effectively capture language abilities in MV children; however, researchers and practitioners should be cautious in using and interpreting the age equivalents given by these measures. Although results show JA, imitation, and nonverbal cognitive abilities are important skills for language, these only account for about 20-25% of variance. This suggests that language development is a complex process for MV children with ASD and needs further investigation.

79 **107.079** Language Development in Dual Language Learners with Autism Spectrum Disorder and Other Developmental Delays

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Background: Many parents and child-development specialists believe that dual language exposure (DLE) delays language development in children with autism spectrum disorder (ASD). Accordingly, parents report limiting communication directed to children with ASD to one language, which confers additional burdens on parents and further isolates the affected children from their family and culture (e.g., Yu, 2013). Few studies have looked at the impact of DLE on language acquisition in very young children with ASD before they receive intervention.
Objectives: This study aims to assess the early receptive and expressive language abilities of children with ASD and other developmental delays (DD; i.e., Global Developmental Delay or Language Delay) from bilingual and monolingual families.
Methods: Participants were 256 children (199 males; mean age 26 ± 4.66 months) evaluated as part of a larger study on the early detection of ASD. Parents were asked to list all languages that primary caretakers used to communicate with their child. 63 dual-language exposed (DLE) children (37 ASD, 26 DD) were compared to 193 single-language exposed (SLE) children (119 ASD, 74 DD). The Mullen Scales of Early Learning (MSEL) was used to assess nonverbal (visual reception (VR), fine motor (FM)) and verbal (receptive and expressive) abilities. Diagnoses were assigned according to DSM-IV-TR, using clinical best estimate judgment of symptoms based on observation, history, and testing. Multiple regression was used to evaluate the relationship of DLE to language abilities, beyond the influence of nonverbal cognitive abilities, diagnosis, and household income.
Results: Language Group (DLE; SLE) did not predict receptive (β = -.09, p=.14) or expressive (β = -.08, p= 0.22) language ability. When household income, diagnosis (ASD; DD), and nonverbal IQ (VR; FM) were added to the model, all variables explained 42% of variance in receptive language scores. Language group remained nonsignificant in predicting receptive language ability, β = -.08, p=.12. Income (β=.05, p=.30) and FM (β = -.01, p=.86) similarly did not predict receptive language, but diagnosis (β=.22, p<.05) and VR scores (β=.58, p<.05) were associated with receptive language. In the prediction of expressive language scores, income, diagnosis, nonverbal IQ, and language group together predicted 35% of variance. Language group (β = -.04, p=.46), diagnosis (β = .04, p= .41), and income (β = .10, p=.06) did not predict expressive language, but VR (β=.41, p<.05), and FM (β =.20, p<.05) did.
Conclusions: This study explored whether very young children with ASD or other delays growing up in DLE households differed in receptive and expressive language development in comparison with children raised in SLE homes, before diagnosis or intervention. The results suggest that young children with ASD and other developmental delays have comparable receptive and expressive language abilities, regardless of whether they come from a monolingual or bilingual home. Instead, receptive language development is better explained by visual reception abilities and diagnosis, and expressive language is better explained by visual reception and fine motor skills. This study suggests that bilingual parents can communicate with their children in their preferred language, or in both languages, without harm to language development.

80 **107.080** Language Outcomes for Children on the Autism Spectrum with Differing Language Development Profiles: What Is the Role of Nviq?

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Background: Language and Communication deficits are required for a diagnosis of Autism Spectrum Disorders (ASD), and many ASD individuals experience overall language delay or regression. Some children, however, develop basic aspects of language within normal limits (i.e. single words and phrases). IQ has been shown in numerous studies to moderate many areas of development in ASD. No study has looked specifically at Nonverbal IQ and its relationship with different language trajectories.
Objectives: We hypothesized that children with higher NVIQ scores with language delays or regression would have higher receptive and expressive skills. Additionally, we expected that children who developed language predominantly within normal limits would have the strongest receptive and expressive skills.
Methods: A sample of 473 children (77.6% male), aged 5-22 years (mean=9.8, SD=3.6) were included in analysis. All participants had a research confirmed ASD diagnosis using ADOS and ADI-R. Receptive and Expressive skills were assessed with Vineland Adaptive Behavior Scale, Second Edition and IQ was assessed with either the Mullen Scales of Early Learning or Differential Abilities Scales. We divided our sample into three groups: a) normal limits; b) delay; and c) regression. Assignment of groups was based on ADI-R questions regarding language development (Question Items 9, 10, and 11) . Pearson Correlations and One-Way ANOVAs were used to determine the relationship between NVIQ and receptive and expressive language skills. Additionally, Multiple Linear Regression Models were created for receptive and expressive language to assess the contribution of NVIQ and language group. All statistics were run using SPSS.
Results: Both receptive and expressive language skills were positively associated with NVIQ (receptive: r=0.183, p=0.002; expressive r=0.388, p<0.001). There were significant differences in receptive (p=0.05) and expressive skills (p<0.001) across the groups. The significant difference was only between the normal limit group and regression group (Receptive: p=0.03; expressive: p<0.001). Children in the normal limit group had the highest receptive and expressive language skills, followed by the delay group, and the regression group had the poorest language skills. Significant results were found for both regression models (Receptive: F(2,269)=4.911, p=0.009, R2=0.35; Expressive: F(2,270)=26.152, p<0.001, R2=0.162). The language category only significantly contributed the expressive language model (Receptive: Beta=-0.035, p=0.56, n.s; Expressive: Beta=-0.113, p=0.045), while NVIQ significantly contributed to both models (Receptive: Beta=0.178, p=0.004; Expressive: Beta=0.372 , p<0.001).
Conclusions: Results confirm the initial hypothesis. The only significant difference in language skills was seen between children with typical language development and children with language regression. NVIQ was a significant contributor to both regression models, while language category was only significant in the expressive language model. While NVIQ and language category accounted for some variance in language skills, a large percentage of the variance wasn't accounted for.

81 **107.081** Language Subdomains Among Young Children with Autism Spectrum Disorder: Associations with Social Skills

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Background:
As deficits in both language and social skills often remain impairing symptoms of autism spectrum disorder (ASD), considerable research has been devoted towards better understanding the nature of these co-occurring, yet distinct symptom clusters. Although a meaningful proportion of children with ASD evidence difficulties across language domains, the majority of prior research has focused on pragmatic language skills. However, given the multi-faceted nature of language skills, there is a need for research that examines how specific aspects of language relate to social skills development.
Objectives:
Examine the association between multiple language domains (e.g., phonology, semantics, syntax, pragmatics) and social skills among children with ASD.
Methods:
Participants included children with ASD (N=196) between 4 and 7 years of age, their caregivers, and teachers. Using the Children's Communicative Checklist-2 (CCC-2) and Social Skills Improvement System (SSIS), we examined how multiple aspects of language cumulatively relate to social skills. We also examined whether any one language domain was uniquely related to social skills above and beyond the other language domains.
Results:
The CCC-2 includes multiple pragmatic language subscales, given that pragmatic language is a multi-faceted language domain. Thus, as a first step we examined five aspects of pragmatic language (coherence, scripted language, context, social relations, nonverbal communication) to determine which one was most strongly associated with social skills. Only the non-verbal communication subscale emerged as significantly related to social skills, and thus was included in subsequent analyses. In a combined linear regression with parent-reported social skills as the dependent variable, with phonology, semantics, syntactic, and pragmatic language skills all entered in the same step of the regression, 17.8% of the variance in children's social skills was explained by their language skills, $F(4, 173) = 10.599$, $p = .000$. In this combined model, children's syntactic ($\beta = -.258$, $p = .010$) and pragmatic language skills ($\beta = .320$, $p = .000$) uniquely related to social skills, but semantic and phonological skills did not. In a combined linear regression with teacher-reported social skills as the dependent variable, 6.3% of the variance in social skills was explained by their language skills, $F(4, 129) = 3.234$, $p = .014$. Interestingly, children's syntactic language skills ($\beta = .411$, $p = .002$) uniquely related to social skills, while semantics, phonology, and pragmatics were not significantly associated with teacher-reported social skills. Overall, syntactic language skills emerged as significantly related to social skills in both home and school contexts; whereas pragmatic language skills were significantly associated with home-based, but not school-based social skills.
Conclusions:
The results of the present study indicate that in addition to pragmatic language skills, more structural aspects of language, such syntax, may also influence social skills among children with ASD. Given the well-documented association between pragmatic language skills and social skills in ASD, the majority of intervention programs generally focus on pragmatic language skills development. However, the results of the present study indicate that syntactic language skills are also related to social skills development, and may thus be a critical, yet largely untapped route of intervention.

82 **107.082** Leveraging AAC Usage Patterns for Diagnostic Classification: A Proof of Concept

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Background: Augmentative and Alternative Communication (AAC) apps are widely used to facilitate communication and enhance language learning in individuals with disabilities such as autism spectrum disorder (ASD). However, to date, the utility and potential of the massive streams of usage data generated by these apps has been little explored from a data mining perspective.
Objectives: To use data mining techniques to generate a novel feature representation and analysis approach that targets differences in AAC usage patterns between users with and without ASD.
Methods: The data used in this study represents the key presses of 189 users (81 ASD, 30 TD, and 78 with aphasia, language disorder, learning disability, or other disorders) over several sessions with FreeSpeech, an iPad AAC application that provides audio when users select pictures. The user's keypresses are categorically sorted and each key is given a unique identifier in the range of its associated category. Using a sliding window of 20 keypresses with 75% overlap, usage data is segmented and each segment is considered as a standalone sample. Random Forest (RF) and Linear-Support Vector Machine (Linear-SVM) algorithms are used to distinguish ASD and non-ASD users based on 20 keypress usage patterns. 10 repetitions of K-fold-cross-validation (k=10) with 0.9 and 0.1 ratios for training and testing is considered. Accuracy and Cohen's Kappa were compared for models' performance.
Results: 12882 sessions of 20 keypresses are extracted from the 189 users (ASD=8567 sessions, non-ASD=4315 sessions). Chance-level performance is 50% and naive constant models achieve 66.5% classification accuracy by assigning every session to ASD. Linear-SVM achieved slightly above chance performance (68.27% accuracy and 0.17 Cohen's Kappa). RF achieved 79.33% accuracy (recall=0.85,precision=0.84), 0.53 Cohen's Kappa, and chi-square 3709.3 (p<.001).Â Two additional window sizes of 10 and 15 keypresses were also considered for RF, achieving 74.54% and 74.18% classification accuracy, respectively. Slightly better performances achieved by window-size 20 likely indicate that users' behaviors patterns get distorted when shorter number of keypresses are considered.
Conclusions: We investigated the informativeness of a feature representation mechanism that converts nonstationary keypress recordings to stationary and sliding time-windowed-patterns. The feasibility of our feature representation method is evidenced by the good performance of RF approach. More comprehensive data collection and classification model training will allow for the generation of more robust and accurate models that can be coupled with the application for real time analysis of user usage pattern with ability to provide adaptive content potentially based on usage patterns.

83 **107.083** Linguistic Camouflage in Girls with Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) is diagnosed more frequently in boys than girls, even when girls are equally symptomatic (Dworzynski, Ronald, Bolton, & Happé, 2012). Recent research points to "camouflaging" in girls with ASD, in which social behaviors appear superficially typical and contribute to diagnostic challenges (Rynkiewicz et al., 2016). We explore linguistic features that may contribute to the female camouflage effect in ASD. Pauses in natural conversation are filled with words like "um" or "uh", which serve distinct pragmatic functions (Fox Tree, 2001). Typical participants fill more pauses with "um" than participants with ASD (Gorman et al., 2016; Irvine, Eigsti, & Fein, 2016), but it is unknown whether this effect may be moderated by population sex differences, since large-scale studies show that women generally use more "um" and men use more "uh" (Acton, 2011; Wieling et al., 2016). We test whether typical sex differences in "um" vs. "uh" exist in school-aged boys and girls with ASD, and whether filled pauses relate to dimensional measures of socialization.
Objectives: Compare rates of "um" and "uh" use in boys and girls with ASD, and assess relationships between filled pause type and parent reported social functioning.
Methods: Participants were 65 verbal school-aged participants with ASD (49 boys and 16 girls), with IQ estimates in the Average range. Speech samples from the conversation and reporting section of the Autism Diagnostic Observation Schedule – 2nd Edition were orthographically transcribed and time-aligned, and filled pauses marked. Parents completed the Social Communication Questionnaire (SCQ) and the Vineland Adaptive Behavior Scales-2ndEdition.
Results: Multiple regressions using age, IQ, sex, SCQ, and Vineland scores to predict rates of "uh", "um", and "um ratio" revealed significant effects of sex and Vineland Socialization domain scores on "uh" and "relative um" but not "um" alone (see Table 1). Consistent with sex differences in filled pause use in the general population, t-tests revealed that boys with ASD produced more "uh" than girls with ASD. Increased "relative um" use by boys correlated with less severe ASD symptomatology; this effect was driven by increased use of "uh" by boys with greater symptoms. "Uh" was a consistent predictor of poorer parent reported socialization across both sexes, whereas "um" was not (see Figures A, B).
Conclusions: Language may have a significant impact on the way children are perceived, with typical-sounding patterns potentially serving as "linguistic camouflage" for girls with ASD. In this study, the extent to which girls used "um" predicted better parent reported social functioning. This link suggests that "um" is a gender-socialized linguistic marker and not associated with ASD *per se*. On the other hand, increased "uh" use correlated with poorer social functioning in *both* groups, suggesting that it may be associated with ASD across both sexes. This study highlights the importance of continued commitment to understanding the complex web of biological and environmental factors that influence ASD emergence and presentation in children, including sex and gender socialization.

84 **107.084** Measuring Small but Important Changes in Minimally Verbal Children with ASD

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Background: Few measures are available that reflect changes in the quality of prelinguistic communication. Brady and colleagues have been developing and testing a scale called the Communication Complexity Scale (CCS) designed to reflect qualitative changes in the forms and functions of prelinguistic communication by individuals with severe ID (Brady et al., 2012).
Objectives: The current study focuses on how different scores that can be derived from the CCS compare to scores from other measures, and predict changes over time.
Methods: 125 individuals with ASD between the ages of 3-60 years were concurrently assessed with the CCS and two other measures of early communication- the Communication Matrix (Rowland & Fried-Oken, 2010) and the Communication Subscales from the Vineland II (Sparrow, Cicchetti, & Balla, 2005). 110 additional children with ASD were assessed with the CCS and the Early Social Communication Scales (ESCS) (Mundy, Hogan, & Doehring, 1996) pre and post intervention.
Results: 1. Scores derived from the three best communication attempts during the CCS (Optimal) correlate higher with scores from the Matrix and VABS2 than modal scores. 2. Significant changes pre-post intervention were detected after 6 months of intervention with CCS scores and the rate of joint attention communication. Only changes in rates of behavior regulation were significant for children in shorter interventions. 3. Changes measured with the CCS were similar to those measured with rates of joint attention and behavior regulation measured during the ESCS.
Conclusions: The CCS picked up changes in the quality of prelinguistic communication including advancements in gestures, eye gaze and functions of communication. These changes paralleled changes in quantity of communication.

85 **107.085** Meeting Language Milestones May Not be Associated with Better Functioning at School Age If ASD Is Not Detected Early

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Background: Previous studies have reported that early language milestones are useful for predicting prognosis of ASD (e.g., Kover et al., 2016; Mayo et al., 2013). However, these studies included only children whose ASD was detected during toddlerhood. There is evidence that ASD tends to be diagnosed earlier in children with language delay (LD) than in children with no language delay (NLD; e.g., Mandell et al., 2005). Therefore, children with LD may be more likely to receive early intervention, which could improve subsequent functioning (Estes et al., 2015). Thus, if ASD remains undetected longer in children with NLD, they may not experience better outcomes than children with LD.
Objectives: This study compared age of diagnosis, adaptive functioning, and ASD symptomatology of a group of children with LD and a well-matched group of children with NLD, whose ASD was not diagnosed during early toddlerhood.
Methods: Using retrospective record review, scores on gold standard diagnostic and developmental assessments were examined in a sample of 110 school-age children (ages 5-18 years) with ASD. All children had a clinical diagnosis of ASD and met criteria on the Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview-Revised (ADI-R). Fifty-five children had typical phrase speech onset (i.e., < 33 months, as reported on the ADI-R). These children were individually matched on age and sex (45 males, 10 females) to children with delayed phrase speech onset. Measures included ADI-R diagnostic algorithm and current behavior scores, ADOS calibrated severity scores (CSS), Vineland Adaptive Behavior Scales standard scores, and age of diagnosis. Normally distributed variables were compared using 2 (group) x 2 (sex) ANOVAs. Non-normally distributed variables were compared using Mann-Whitney *U* tests.
Results: There was a significant group difference in age of diagnosis (U = 968, p = .001, r = .395), with the NLD group being diagnosed relatively late (M = 8.39 years, median = 6.89) compared to the LD group (M = 5.28 years, median = 4.16). There were significant main effects of group for all ADI-R diagnostic algorithm domains (Fs > 11, ps < .001), as well as ADI-R current behavior scores in the communication and restricted repetitive behavior domains (i.e., fewer/less severe symptoms in the NLD group). However, there were no main effects of group for ADI-R current behavior in the social interaction domain, ADOS CSS or Vineland scores in any domain (all Fs < 3.7, ps > .05).
Conclusions: On average, children with NLD were diagnosed 3 years later than children with LD. Despite having typical language onset and fewer early ASD symptoms (i.e., lower ADI-R diagnostic algorithm scores), the NLD group resembled the LD group in several aspects of functioning at school-age. Specifically, at school age, both groups had moderate-to-severe ASD symptoms (i.e., ADOS CSS) and low adaptive functioning scores (i.e., below age expectations in all Vineland domains). Therefore, typical language onset was not an indicator of better prognosis in late-diagnosed children with ASD. This research highlights the importance of earlier ASD detection and intervention.

86 **107.086** Narrative Generation in Children with ASD: The Effects of a Reading Comprehension Intervention on Mental State Use

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Background: Â Higher functioning children with ASD (HFASD) often exhibit well-developed word level reading skills but tend to have deficits in reading comprehension. The cognitive skills involved in narrative retelling of stories is associated with reading comprehension in HFASD students and may be an important target of intervention in schools for these children. Some research has suggested that children with ASD can increase their narrative competence through exposure to storybooks, with prompting to focus attention on characters' cognitive and affective states. Indeed, these types of narrative interventions may contribute to more generalized social outcomes, and have been found to increase perspective-taking and social cognition in school-aged children with ASD.
Objectives: Â The purpose of this preliminary study was to examine if a brief curriculum-based comprehension intervention had effects on the narrative abilities of children with ASD.Â The hypothesis was that children's narratives would include more story elements and evaluative terms following the intervention, indicative of improvements in perspective-taking and social cognitive abilities.
Methods: Â Participants included fifteen 7- to 12-year-old children with ASD. Children participated in an eight-week intervention program, consisting of thrice-weekly, one-hour sessions. Each session emphasized a particular comprehension skill taught explicitly with guided opportunities for practice within a children's book. A spontaneous narrative generation task was administered pre and post intervention, using a wordless picture book to elicit narrative. The book *Frog, Where Are You?* (Mayer, 1969), a story about a boy who searches for his missing pet frog, was used for the pre-intervention narrative assessment, and the post-intervention book, *A Boy, a Dog, and a Frog* (Mayer, 1971) continues the story of the boy and the frog. Narratives were transcribed and coded for terms referring to characters' affective (e.g., "laughed", "upset") and cognitive states (e.g., "know," "wondered").
Results: A paired-samples t-test was conducted to compare pre- and post-mental state usage, and revealed a significant difference in the number of mental state terms used pre- (M = 2.67, SD = 2.89) and post- (M = 4.53, SD = 4.03) intervention; t (14) = 2.56, p< .05. Preliminary analyses also showed a significant bivariate correlation between children's pre-intervention expressive vocabulary score and the frequency of mental state use at post-test, r (13) = .56, p< .05. The results of additional planned analyses will be conducted to include additional codes for story structure and length, and the relations between mental-state use and parent report measures of children's social ability will also be examined.
Conclusions: Â This study provided evidence for the malleability of narrative retelling ability in a sample of HFASD children. This is important because of the ease with which this type of intervention can be integrated into school curriculums and because intervention for narrative retelling may be important to support reading comprehension development in these children. Moreover, such interventions may also provide means to leverage a component of school curriculums to more systematically impact social cognitive development in school aged children with HFASD. Research is planned to more rigorously test these hypotheses with randomized experimental control group intervention study designs.

87 **107.087** Nonshared Environmental Influences on Language Development: A Monozygotic Twin Differences Study

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Background: Although linguistic impairment is no longer a diagnostic criterion for autism spectrum disorder, it remains a key area of focus and concern for many individuals and families. Given the recent focus on genetic influences on both autism and linguistic impairments more broadly, the study of environmental influences remains underdeveloped. Prior behavioral genetic work on language development has emphasized the role of both genetic and environmental influences, with the specific finding that nonshared (or person-specific) environmental (NSE) influences account for 5-90% of individual variation depending on age and the measures employed. Monozygotic (MZ) twin difference analyses provide a unique opportunity to identify NSE effects by examining the extent to which differences in specific environmental variables, such as diet, are associated with differences in language outcomes within MZ twin pairs who share approximately 100% of their DNA. The present study builds on prior behavioral genetic studies of language (DeThorne et al., 2012; 2016) and offers to the best of our knowledge, the first application of the MZ twin differences method to understanding NSE influence on children's language development.Â Objectives: This work investigates NSE associations between specific environmental measures (i.e., gap between birth, weight at birth, extent of breast feeding, reading exposure, media viewing, and parental warmth) and language development at two time points (mean ages 7 and 12 years). Methods: Participants consist of approximately 215 MZ twin pairs from the Western Reserve Reading and Math Project (WRRMP; Petrill et al., 2006), a longitudinal study of reading development and related skills. The analysis focuses on data collected from home visit 2 (HV2) and HV7, during 1st and 5thgrade respectively. Each annual home visit included standardized measures, language samples, and parent questionnaires; 7-8% of the sample was receiving speech-language pathology services when they entered the study. Language measures were loaded into two latent factors: a Productive language factor and a Formal language factor, measured by language sampling and standardized tests respectively. An MZ differences method will be employed to examine associations between the NSE measures and the two language factors. Results: Based on previous research, we predict that differential birth weight and breastfeeding will be associated with differential language outcomes. Although previous literature has linked reading exposure, media viewing, and parental warmth with language outcomes, few studies have been conducted within the context of a genetically sensitive design. To our knowledge there has been no prior research examining the association between gap between twin birth and language outcomes; research has shown, however, the second-born twin is more likely to have more neonatal complications (e.g., respiratory distress syndrome) than the first-born twin. Subsequently, predictions are less clear. Consistent with prior work, we predict NSE relationships to be moderated by the form of assessment. Finally, we anticipate increased NSE associations at the extremes of discordance compared with the full unselected sample. Conclusions: The present study will elucidate potential NSE factors that may impact language development, measured by both language sampling and standardized tests. Future directions and clinical implications will be discussed.

88 **107.088** Objective Acoustic-Prosodic and Turn-Taking Measures in Interactions with Children with Neurodevelopmental Disorders

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Background: Â Speech prosody—referring to the manner in which a phrase is uttered to enhance meaning beyond the spoken words—plays a critical role in social reciprocity and affect. Effective expression (and perception) of prosody is essential to portraying (and understanding) communicative intent, and thus enhancing conversational quality. Atypical prosody is a well-documented behavioral marker of ASD that presents across the lifespan, yet it is not well-defined. Descriptions of atypical prosody are qualitative, subjective, and contrasting, and inter-rater agreement remains low. As such, incidence rates for various types of prosodic abnormalities are unknown.

Objectives: Â Automatic quantitative analysis of large corpora comprising natural communication with ASD subjects has the potential to provide novel information to researchers and clinicians. Further, given the great heterogeneity of symptoms in autism spectrum disorder (ASD), an acoustic-based objective measure would be valuable for clinical assessment and interventions. In this study, we investigate objective speech features in child-psychologist conversational samples. Expanding upon previous studies, we investigate (i) the speech of children with non-ASD developmental disorders (DD) and (ii) the stability of certain prosodic attributes, gaining insights into the effects of ASD severity and diagnosis on the child's prosody and quality of interaction.

Methods: Â Audio-visual data of semi-structured child-psychologist interactions during the Autism Diagnostic Observation Schedule (ADOS) from two collection sites are used for this study. Data consist of age- and IQ-matched ADOS Module 3 administrations for ASD (N=95) and DD (N=81) subjects. Speech acoustic-prosodic features are computed after first aligning lexical transcriptions to the audio signals. Prosody is quantified in terms of segmental intonation (syllable-level), supra-segmental intonation (multi-syllabic contour modeling via Momel/Intsint parameterization), speech rate (syl/s), and coordination of prosodic attributes (pitch/volume/duration); we also investigate measures of turn-taking. Analyses are conducted via correlation and predictive regression between prosodic cues and ADOS severity.

Results: Â The automatically extracted prosodic and turn-taking cues correlate with the child's ASD severity/diagnosis and are demonstrated to have significant predictive performance. For example, in interactions with children having higher ASD severity: segmental and supra-segmental prosodic variability increases for both participants; the child has reduced coordination between their pitch and duration/volume; and the child speaks less, at a slower rate, and with more pausing. Additionally, the psychologist's speech features were as predictive of the child's severity as the child's features. We will also provide a statistical analysis of the stability of these vocal characteristics across the interaction.

Conclusions: Â TheÂ acoustic-prosodic and turn-taking cues are reflective of ASD severity and diagnosis. Likewise, the psychologist, who is also an interlocutor in the interaction, adjusts her behavior in predictably ways. This work is part of a larger effort to create an automatic system for evaluating various dimensions of naturalistic social prosody. Findings support further, large-scale study of objective measures of prosody in interactions involving children with ASD.

Figure 1: Example intonation contour with corresponding Momel/Intsint modeling.

89 **107.089** Optimizing Thin-Slice Observations for Toddlers with Autism

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Background: The Thin-Slice is a measure of behavior from using only small observations (less than 5-minutes). When multiple raters observe the same small behavioral sample, the average score is often reliable with other measures of the same construct and valid for predicting future outcomes (Slepian, Bogart & Ambady, 2014). The Thin-Slice has been used to rate a wide variety of personality characteristics and psychological outcomes such as, marital satisfaction, depression, success, and communicative ability. The Thin-Slice has only recently been applied to observations of children with autism (Walton & Ingersoll, 2015). Although a recent application of the Thin-Slice to children with autism demonstrates reliability and validity, it does not provide guidelines for achieving an optimal Thin-Slice score based on observation length and number of raters.
Objectives: The objective of the current study is to extend the current Thin-Slice work in Autism by demonstrating the optimal number of raters and optimal number of observations to determine a stable estimate of communication ability in toddlers with autism by answering the following questions. 1) Are thin-slice observations from a) a 2-minute video and b) a 2-minute audio recording from the home environment a reliable and valid for estimating communicative ability in toddlers with autism? 2) What is the optimal number of raters and 2-minute samples from a) a video and b) audio-only to achieve a stable estimate of communicative ability in toddlers with autism?
Methods: Participants include 40 2-year olds (72% male) with autism. Each child received a diagnostic assessment using the ADOS at the start of the study. Day-long audio recordings, using LENA technology, were also collected at the start of the study. Two-minute slices of assessor-child interactions from the ADOS and 2-minute slices from the LENA recordings will be used to rate the children on 6 features: communication, speech ability, engagement, play, joint attention, and imitation using a 5-point Likert scale by 10 raters. Each two-minute slice will be rated by 20 speech-pathology students, and the scores of each rater will be averaged to obtain a single score for each observation.
Results: Results from this study are ongoing. Final analysis will include generalizability estimates for each additional rater, and a decision study will estimate the optimal number raters and slices necessary to achieve a stable measure of communication ability. Reliability with other baseline communication measures will be established (naturalistic language sample, CSBS, and MCDI) as well as predictive validity to overall ADOS severity score.
Conclusions: Although this tool is highly appealing, it is necessary to provide guidelines for researchers on how to best optimize this tool and provide reliable and valid estimates. Using snap judgements to inform diagnostics in autism may a useful and important tool not only to increase research efficiency, but to potentially provide greater access to diagnosis for more children by simplifying the screening procedure. Discussion will include applications for LENA technology and the Thin-slice methodology for increasing efficiency and accuracy in estimating communication in toddlers with autism.

90 **107.090** Predictors of Speech Improvement in Minimally Verbal Children with Autism Spectrum Disorder

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Background:
Of the 1 in 68 children who meet criteria for autism spectrum disorder (ASD), approximately 25% remain minimally verbal (meaning they use fewer than 20 words functionally and have no productive syntax) past the age of 5 years. Previous work has identified both child and therapy characteristics that predict growth in vocabulary and communication rate (Rogers et al. 2006; Paul et al. 2013) and expressive language (Paul et al., 2013; Yoder et al., 2015) in minimally verbal children with ASD, but to date, no research has sought to determine characteristics that predict speech acquisition in minimally verbal children with ASD.
Objectives:
In this study, we aimed to identify child characteristics that predicted response to two therapies designed to facilitate spoken language in minimally verbal children with ASD.
Methods:
Thirty minimally verbal children with ASD (four female) between the ages of 3;5 and 9;8 participated in one of two treatments. Twenty-three children (two female) received 25 sessions of Auditory-Motor Mapping Training (AMMT), an intonation-based treatment involving repetition of sung bisyllabic stimuli and simultaneous tapping on tuned electronic drums. Seven children (two female) receivedÂ 25 sessions of Speech Repetition Therapy (SRT), which involves neither intonation nor drum-tapping but is otherwise matched to AMMT. Children's Baseline responses to two sets of stimuli were transcribed, then scored for percent consonants and vowels correct and percent syllables approximately correct. Chronological age and the number of English phonemes they were able to repeat on request at Baseline were also tallied. All five Baseline measures (age, size of phonetic inventory, percent syllables approximately correct, and percent consonants and vowels correct) were then entered into a hierarchical multiple regression to predict the change score in percent syllables approximately correct.
Results:
The full model, including all five predictors, was significant, $R^2 = .534$, $F(5,24) = 5.508$, $p = .002$. In the hierarchical analysis, only Baseline phonetic inventory, Baseline percent consonants correct, and Baseline percent syllables approximately correct resulted in statistically significant increases in R^2. Examination of regression coefficients showed that size of phonetic inventory was significantly associated with increase in percent syllables approximately correct, while Baseline percent syllables approximately correct and Baseline percent consonants correct were significantly associated with decreases in percent syllables approximately correct.
Conclusions:
The positive moderating effect of phonetic inventory suggests that the ability to correctly imitate phonemes on request is an indicator for degree of improvement in the ability to produce word approximations seen after 25 therapy sessions. The negative moderating effect of baseline percent syllables approximately correct and baseline percent consonants correct suggests that previously learned word approximations may be challenging to improve upon in this amount of time. However, anecdotal observations and parent reports suggest that these children can continue to improve their speech output even after therapy ends.

91 **107.091** Problem Behaviors in Autism Spectrum Disorder: Is Communication a Specialized Adapting/Coping Mechanism?

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Background: The inability of an individual to clearly communicate wants/needs is thought to lead to problem behaviors such as self-injurious behavior (SIB), aggression, temper tantrums, and noncompliance (Ganz et al., 2009; Hartley et al., 2008). Even though a number of studies support the association between problem behaviors and language/communication skills in children with autism spectrum disorder (ASD), this has not been a universal finding (e.g., Chiang, 2008). Problem behaviors have also been characterized as "coping behaviors" (Groden et al., 1994), meaning they are not necessarily externally-directed communication but are responses to perceived increases in undesirable physiological reactions. According to this framework, development of a more appropriate means of communication would be considered as establishing a specialized adapting/coping mechanism (Ladd, 2007).
Objectives: Data from the Autism Inpatient Collection (AIC) was used to examine the proposal that communication is a specialized adapting/coping behavior with the related expectation that measures of socially-acceptable coping skills would be inversely related to the frequency of problem behaviors and would be more predictive of the severity and frequency of problem behaviors than communication ability.
Methods: Participants were 346 psychiatric inpatients with ASD supported by research-reliable ADOS-2, divided into verbal-ability groups based on their required ADOS-2 module [169 minimally-verbal (MV; Modules 1 and 2) and 177 fluently-verbal (FV; Modules 3 and 4)], aged 4 to 21-years [MV Mean = 13.0 (SD 3.7); FV Mean = 12.8 (SD 2.8)]. Dependent measures included the *Repetitive Behavior Scale-Revised*, *Aberrant Behavior Checklist* Stereotypy and Irritability subscales, and *Vineland Adaptive Behavior Scale-II* Externalizing subscale (VABS-II). Independent measures, in addition to verbal ability category and age, included NVIQ (*Leiter International Performance Scale – Third Edition*), and VABS-II Adapting/Coping subdomain (30-item scale including items such as manners, adherence to rules, and flexibility; higher scores indicate greater ability to flexibly adapt to environmental demands.) ANCOVA was used to compare the mean of problem behavior severity for each dependent variable between MV and FV participants with NVIQ and age as covariates. A series of hierarchical linear regressions were conducted to determine the incremental explanatory power of each independent variable, which were entered separately in their own step, in the following order: age, NVIQ, verbal ability, and VABS Adapting/Coping.
Results: The severity of SIB, stereotyped behavior, and irritability (including aggression and tantrums) did not significantly differ between MV and FV, when controlling for age and NVIQ. Adapting/coping was a significant predictor in every regression model, accounting for a significant amount of variance above and beyond age, NVIQ, and verbal ability. Lower adapting/coping scores were associated with greater problem behaviors. Verbal ability accounted for an additional 21.3% of the variance in Externalizing problems above and beyond age and NVIQ IQ, but it did not account for a significant amount of additional variance for any other problem behavior.
Conclusions: Increasing severity of each type of problem behavior was significantly associated with lower adapting/coping scores, even when accounting for verbal ability. Interventions may need to focus on the development of adapting/coping mechanisms to mitigate problem behaviors in individuals with ASD.

92 **107.092** Qualitative Differences of Joint Focus of Attention Between Korean-Speaking Toddlers with Autistic Spectrum Disorder and Toddlers with Developmental Disabilities

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Background: It has been reported in the literature that children with autistic spectrum disorder (ASD) share a number of features with other children with developmental disabilities (DD), involving difficulty with joint focus of attention (JFA). As well known, impaired JFA may affect more advanced communication skills.
Objectives: The present study aims at investigating the complexity of child JFA behaviors in toddlers with ASD as compared with those with DD in terms of dyadic and triadic joint interactions. Participants were forty-five in total, composed of twenty-eight Korean-speaking children with ASD (27 males and 1 female, M=30.6 months, CA range=21-37 months, SD=4.5 months) and seventeen Korean-speaking children with DD (14 males and 3 females, M=31.4 months, CA range=13-39 months, SD=6.4 months). For the purpose of this research, dyadic JFA is defined as acts of exchanging facial expressions and of pointing and showing behaviors, triadic JFA being marked by the individual coordinating their attention back and forth between himself and the other individual after looking at the same object in one activity.
Methods: Each of 45 mother-child dyads was observed during a 10-minute videotaped free-play session in a sound-proof lab designed for child study provided with a standardized set of toys such as a doll, cars, trucks, a spinner, books, and stuffed animals. The parent was instructed to respond naturally when the child was seeking an interaction. The video segments of mother-child interactions were transcribed and coded verbatim in CHAT modes by trained students and coders for three main categories of utterances (verbal, non-verbal, and vocative) and two types of interactions (dyadic and triadic), and CLAN was performed for final results to be obtained.
Results: Data analyses showed that there were no statistically significant quantitative differences between the children with ASD and those with DD regarding the JFAs expressed in all three main categories, verbal, nonverbal, and vocative utterances, while the number of JFAs was greater than that of Non-JFAs in both groups. Qualitative differences between them, however, emerged with respect to the JFAs across the three main categories. No statistically significant difference was found between the two groups as far as dyadic interactions were concerned. Importantly, on the other hand, the two groups differed statistically significantly regarding the triadic JFAs across the three main categories (verbal 4.93(SD=10.0) vs. 3.24(SD=6.43), $t(43) = 2.179$, $p = .036$; non-verbal 14.79(SD=15.47) vs. 26.0(SD=20.29), $t(43) = -2.094$, $p = .042$; vocatives 1.36(SD=3.06) vs. 3.47(3.09), $t(43) = -2.241$, $p = .030$).
Conclusions: Overall, our results are noteworthy in that children with ASD were significantly different from and more impaired than those with DD in triadic JFAs, but not in dyadic JFAs. This finding is extremely important in two respects. It supports previous research on prominent impairment of JFAs in children with ASD and with DD. It further provides an insight into the ongoing research on the development of JFA in ASD and DD toddlers, suggesting that they should be differentiated on rather specific terms involving qualitative differences of JFAs, in particular.

93 **107.093** Receptive and Expressive Language Skills and Non-Verbal Cognitive Abilities Among Preschool-Aged Autistic Children with Delayed Expressive Language

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Background: A DSM-5 autism spectrum diagnosis requires specifying the co-occurrence of language impairment. Considering the gap between receptive and expressive language skills, the APA recommends a separate assessment of these subdomains (APA, 2013). Contrary to typically developing (TD) children, receptive language is usually lower than expressive language in autistic children (Maljaars et al., 2012). Nevertheless, it is sometimes anecdotally reported that some school-aged autistic children demonstrate relatively good receptive skills, despite their low expressive skills (Kasari et al., 2013). Little is known however about receptive versus expressive language skills at preschool age in autistic children. Furthermore, as non-verbal cognitive abilities are a well-documented predictor of language outcomes (Luyster et al., 2008; Thurm et al., 2007), documenting both expressive and receptive language in relation to other important developmental domains such as non-verbal cognitive skills could lead to a better understanding of language development in autism.
Objectives: 1-To compare the differences between expressive and receptive language in preschool-aged autistic and TD children. 2-To compare differences between expressive and receptive language between autistic children with and without delayed expressive language. 3-To compare preschool-aged autistic children with and without delayed expressive language on non-verbal cognitive abilities.
Methods: 53 autistic and 38 TD preschoolers aged from 31 to 78 months (autistic children: M=51.70, SD=12.26; TD children: M=48.73, SD=11.5; p=.25) were assessed with the Vineland Adaptive Behavior Scales (VABS). Autistic children were classified in the delayed expressive language group (DL) (n=27) if their VABS expressive language score was below the second percentile and in the non-delayed expressive language group (NDL) (n=26) if their score was in the normal range (≥2nd percentile). DL and NDL autistic groups were matched on age (p<.89). A subgroup of 29 autistic children (DL: n=12; NDL: n=17), matched on age (p=.05), completed the Raven's Color Progressive Matrices (Board form) (RCPM).
Results: Â A significant interaction was found between group and expressive/receptive language (p<.05). Autistic children had a significantly higher level of receptive language compared to their level of expressive language on the VABS (p<.001) while no difference was found between the two subscales in the TD group (p=.23). Furthermore, when comparing DL and NDL autistic children, only a main effect of type of language was found (p<.001), thus indicating that receptive language was higher than expressive language in both DL and NDL groups. Finally, DL and NDL groups did not differ on RCPM scores (p=.58).
Conclusions: Â Whereas TD preschoolers exhibited similar receptive and expressive language skills, autistic preschoolers were characterized by significantly higher receptive than expressive skills. Indeed, language comprehension seems to outdo language production in autistic preschoolers, regardless of their level of expressive language. Furthermore, despite their greater delay in expressive language, DL children performed as well as NDL children on the RCPM, a non-verbal measure of fluid reasoning. These results suggest that each developmental domain has to be documented separately in autistic preschoolers to have a good representation of their skills.

94 **107.094** Relationships Between Auditory Brainstem Responses and Early Language in Typically-Developing Children and Children with Autism Spectrum Disorders

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Background: The neurological underpinnings of language in Autism Spectrum Disorders (ASD) have long been sought, both to shed light on possible causes of its complex and multi-faceted behavioral presentation, and to identify targets for intervention.Â Our project explores whether abnormalities in language development can be attributed to disruptions at an early stage of auditory processing, namely the auditory brainstem. Recent research has suggested that instability in the nervous system's response to sound, as revealed by comparisons between initial and later test trials of the auditory brainstem response (ABR), and earlier ABR latencies, might be characteristic of children with lower language skills (Hornickel et al., 2013; Skoe et al., 2013).
Objectives: We collect ABRs in school-age children with ASD and typically developing (TD) children, whose early language development has been documented in rich detail (Tek et al., 2014; Naigles & Chin, 2015).Â We investigate the relationship between the ABRs and earlier language measures.
Methods: Fifteen children (one girl) were tested for ABRs; seven had been diagnosed with ASD (*M*Age=11.25) and eight were TD (*M*Age=11.14).Â At their most recent assessment, group average NVIQs were 74.00(ASD) and 102.75(TD); TACL-Q language scores were 73.71(ASD) and 123.63(TD), and ADOS Calibrated Severity Scores were 6.43(ASD) and 1(TD). The children had participated in four mother-child play sessions when they were between 2 and 4 years; the language measures were drawn from their transcripts.Â ABRs were recorded from scalp electrodes in response to a click stimulus (31.1/sec, 2000 trials) and a 40 millisecondÂ "da" stimulus (10.9/sec, 6000 trials) presented at 80 dB SPL to the right ear.Â The latency of Wave V (the most robust peak within the ABR), plus Click and /da/ response stability (Fisher transformed Pearson's r-values), served as the primary dependent measures of sound encoding.
Results: Although the TD children showed numerically faster Wave V latencies than the children with ASD, t-tests revealed no significant differences between the groups on any ABR measure.Â Bivariate correlations including both groups revealed that children who had produced a higher proportion of utterances with nouns during early language development displayed more consistent ABRs, to both the click and /da/ stimuli (*r*s > .54, *p*s < .05), even when age was covaried (see Figure 1). Moreover, children who had produced a higher proportion of utterances with the progressive –ing in their earliest language sample also displayed more consistent ABRs to the click stimulus (r = .525, p = .045). Finally, children's TACL scores were significantly and independently predicted by their ADOS scores (β=-.681, p =.001) and their /da/ consistency (β= .352, p = .039).
Conclusions: Our procedures for collecting ABR data at home from school-age children with ASD yielded waveforms that resembled those collected in lab settings.Â Although group differences were not observed in this small sample, significant correlations across the entire dataset revealed that children who had displayed more advanced language early in development showed more stable neural responses to sound during school age, supporting links between early lexical and grammatical development and sound processing in the auditory brainstem.

95 **107.095** Scatter: Quantifying a Qualitative Vocabulary Difference in Adults with ASD

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Background: Semantic emptiness and odd or imprecise use of vocabulary, in combination with accurate use of unusual words, have been reported in adults with ASD who do not also have language impairment. Such features are not captured by total scores on standardized vocabulary tests, but might be captured by item *scatter*. A scattered or inefficient pattern of responses occurs when early test items are missed and later items are defined correctly, in contrast to a gradual decrease in scores as items become progressively more difficult to define. Scatter is thus consistent with the coexistence of semantic errors and sophisticated word use that has been informally observed in ASD.
Objectives: Whether the uneven quality of vocabulary use in ASD could be quantified using an alternative scoring method of standardized tests was explored here. If adults with ASD demonstrated more scatter in their pattern of responses on a vocabulary test as compared with controls, the result would support observations that have been made both in ASD case studies and in the present sample (Stothers & Oram Cardy, 2016). No significant difference by group in total mean scores for expressive vocabulary was expected. The ASD group was expected to have a significantly higher Scatter score than the control group.
Methods: Adults aged 19–44 years completed the Vocabulary subtest of the Wechsler Abbreviated Scale of Intelligence (WASI), with 21 participants in both the ASD and Control groups (N = 42). Two scoring methods were used. The conventional method followed the WASI scoring protocol. In the Scatter method, original scores of 0 or 1 were coded as failed, and scores of 2 as passed. Item weights were calculated as the percentage of control participants who passed the item. Scatter was equal to the sum of the weights of the items that participants missed, multiplied by the peak item answered correctly.
Results: Â Hypotheses were supported. Group means were not significantly different for the total Vocabulary score, t (40) = .35; p = .78, with a negligible effect size, d = .11. All scaled scores were within or above the average range in both groups. The ASD group had a significantly higher Scatter score than the control group, t (24) = 2.40; p = .02, with a moderate to large effect size, d = .72.
Conclusions: Qualitative differences previously reported for this sample were captured by a quantitative measure. Scatter was shown to be an effective measure of difference, separating the control and ASD groups in the context of equivalent overall scores for Vocabulary. Results supported using this method, in addition to the standard scoring protocol, to more sensitively characterize performance of individuals with ASD without language impairment on standardized tests of word knowledge.

96 **107.096** Second-Order False Belief Reasoning, Recursive Language Competencies and Working Memory in Children with ASD

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Background: Second-order (SO) false belief (FB) competency is an important component of Theory of Mind (TOM). In first-order ToM development, links between language and false belief reasoning have been firmly established and proposed as potential factors in explaining the success of children with ASD who succeed on TOM tasks. However, SOFB development is less studied, and the links between language and SOFB reasoning, as well as the potential developmental role of language, remain unclear.
Objectives: We investigate the relationship of SOFB and several language measures, and in particular, whether competency in linguistic recursion (sentential complements) predicts the ability to reason about other's SOFBs. In addition, we investigate the role of working memory in SOFB development.
Methods: The sample consists of Danish speaking children with ASD without ongoing language delays and with working memory within the normal range. Four types of standard SOFB tasks are given. The standardized language measures include the Verbal Comprehension index from WISC-IV and TROG. Linguistic recursion is investigated using a new Danish language tool that measures comprehension of sentential complements. The tool was developed and validated for this study (Cronbach's alphas 0.56). Working memory is measured by the working memory index from WISC-IV. We are using these measures in an ongoing correlation study. To date, 18 children with ASD, with mean age 12.61 (SD = 3.07), have been tested. ASD was diagnosed by psychiatrists, using the ICD-10 criteria.
Results: Â The Pearson correlation analyses of the three language measures and working memory against three types of dependent variable yielded the following findings: Total SOFB correlates with Verbal Comprehension (r=.482, p=.043) and Working Memory (r=.598, p=.009). SOFB without justification correlates with Verbal Comprehension (r=.641, p=.004), Grammar comprehension (r=.558, p=.016) and Working Memory (r=.621, p=.009).Â Justification-only correlates with working memory (r=.571, p=.006) but none of the language measures.
Conclusions: First, the correlational analysis suggests that verbal concept formation skills (which are influenced by semantic knowledge) are related to SOFB reasoning. However this is not the case for syntactic skills, whether general grammar or recursive sentential complements comprehension. This result points to the influence of semantic and conceptual aspects of language, which are sometimes referred to as "tool for thinking". Furthermore, our correlation data suggests that justification responses cannot be accounted for by language skills, and therefore does not support the claim that language plays an expressive role in SOFB reasoning. Second, the correlational analysis suggests that working memory is related to SOFB reasoning, including justification skills, and thus provides further support to "the complexity-only position" (Miller 2009), claiming that information processing skills predict SOFB development. By the time of IMFAR 2017 the size of our sample will enable us to draw conclusions about how much of the variation can be explained by relative contribution of each language measure and working memory based on multiple regression analysis.
Miller, S. A. (2009). Children's understanding of second-order mental states. *Psychological bulletin*, *135*(5), 749.

97 **107.097** Semantics Is Importantly Significant: An Investigation into Lexical Errors in ASD

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Background: Â There is evidence to suggest that language impairment and autism spectrum disorder (ASD) are separable conditions (Tager-Flusberg, 2006; Rapin et al., 2009). Accordingly, the Diagnostic Statistical Manual no longer includes language impairment as a necessary component of an ASD diagnosis (APA, 2013). However, children with ASD who have good language skills still struggle with some aspects of semantics (Dunn et al., 1996; 1997). Semantic impairments have also been noted in "optimal-outcome" children, i.e., children previously diagnosed with ASD whose social communication skills had improved enough to move them out of the ASD range (Kelley et al., 2006). As yet, it is unclear what types of semantic errors children with ASD produce and whether issues with semantics in children with ASD persist through adolescence or are instead evidence of delayed acquisition in younger children.
Objectives: Â To identify and categorize the semantic errors of children (ages 11-17) with ASD in order to determine an impact of ASD diagnosis on later stages of semantic language development.
Methods: Â Preliminary results are based on ten adolescents with ASD (2 females, ages 11-17) and twenty typically-developing controls (8 females, ages 10-16). Groups were not significantly different on language ability as measured by the CELF-5 (ASD *M* = 114, TD *M* = 115; p = 0.9). Participants were audio-recorded as they interviewed a researcher. We transcribed recordings and coded them for semantic errors, defined as moments when an utterance's meaning was unclear and/or redundant.
Results: Â Error frequency: All participants with ASD produced at least one semantic error, and participants with ASD produced more semantic errors on average than their TD peers (ASD *M* = 7, TD *M* = 2; p < 0.05).
Error types: Participants with ASD misused words and produced neologisms (e.g., "mosquito nicked me"; "electroids"). They also made "lexical disinhibition errors," by producing lexical neighbors, i.e. semantically related words, that were inappropriate to sentential semantics (e.g., "...was large and huge"; "[I see] family, friends, resemblance"). Word-choice errors were rare in the TD group; lexical disinhibition errors were not present.
Conclusions: Â Even though both groups' language scores fell within normal bounds on the CELF-5, adolescents with ASD produced more semantic errors than their TD peers during spontaneous speech, indicating that the ASD group has a subtle semantic impairment that is not captured by traditional language tests.
The types of errors produced by participants with ASD (incorrect word choices and strings of unnecessary lexical neighbors) suggest particular impairments in *lexical* semantics. Disinhibition errors have not previously been described as a feature of language in ASD; they indicate dysfunctional lexical access, which could be caused by executive dysfunction. Future research should explore whether and how lexical disinhibition contributes to semantic impairments in ASD and how these errors affect communicative effectiveness during conversation.

98 **107.098** Sensory Abnormalities Impact on Language Ability in Autism Spectrum Disorder

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Background:
Sensory abnormalities have been found to be highly prevalent in children and adults with autism spectrum disorder (ASD). These manifest as a hypoactive response to sensory input (reduced or absent response), hyperactive response (increased or excessive response), or sensory seeking behaviors (craving or fascination with certain sensory experiences). Research has shown that these sensory disturbances appear early in development, yet it is not clear whether they exert cascading effects on higher cognitive processes like language ability.
Objectives:
We aimed to investigate the relationship between severity of sensory disturbances in children and adolescents with ASD and language ability across both structural and pragmatic language domains. In addition, we were interested in whether language ability is impacted by the type of sensory abnormality (i.e., hyporesponsive, hyperresponsive, or sensory seeking).
Methods:
We used a short sensory questionnaire (Boyd, McBee, Holtzclar, Baranek, & Bodfish, 2009) to create subgroups based on overall sensory severity, and the presence of hyporesponsive, hyperresponsive, and sensory seeking behaviors in a sample of 68 children and adolescents with ASD (mean age: 10.6 years, range 5.9 – 17.9 years; mean IQ: 95.6, range 40-139; 10% female). To examine the relationship between sensory features and language ability, we used Mixed Model ANOVAs to compare the sensory subgroups on their mean subscale scores on the Children's Communication Checklist-2 (*CCC-2*; Bishop, 2003). The *CCC-2Â* is a parent report measure of language functioning with eight subscales including both structural aspects of language (e.g., 'Syntax,' 'Semantics') as well as pragmatic aspects (e.g., 'Use of Context,' 'Nonverbal Communication').
Results:
Children and adolescents with ASD in the high severity sensory subgroup were found to have significantly more impaired language scores compared to the low severity sensory subgroup ($F(1, 46) = 10.2$, $p < .001$) on all *CCC-2* subscales except 'Nonverbal Communication' ($p = .110$). When grouped by the presence of hyporesponsive sensory behaviors, no significant differences were found on language scores between groups ($F(1, 66) = 2.58$, $p = .113$). However, when grouped by the presence of hyperresponsive behaviors, there was a significant main effect of group ($F(1, 66) = 4.6$, $p < .05$), with the hyperresponsive group demonstrating more impaired scores on 'Semantics' and 'Use of Context.' Similarly, the sensory seeking group showed significantly more impaired scores on the 'Syntax' and 'Semantics' subscales compared to individuals without sensory seeking behaviors ($F(1, 66) = 5.88$, $pÂ < .05$).
Conclusions:
Our results suggest that the sensory abnormalities seen in ASD may have downstream effects on both structural and pragmatic language ability, demonstrated by the finding that individuals with more severe sensory scores showed significantly worse language scores. In addition, the type of sensory disturbance may differentially affect aspects of language, with hyperresponsive and sensory seeking behaviors having a greater impact on language ability.

99 **107.099** Sentence Repetition and Nonword Repetition As Markers of Structural Language Impairment in ASD

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Background: The nature of linguistic profiles in ASD remains unclear: many children show structural language abilities similar to typically developing age-peers (TD), others display deficits like those in Specific Language Impairment (SLI) (Leyfer et al., 2008; Lloyd et al., 2006; Loucas et al., 2012; Tuller et al. 2016; Zebib et al., 2013). There is consensus from work on SLI that the most sensitive tools for detecting structural language impairment are Sentence Repetition (SR) and Nonword Repetition (NWR) (Conti-Ramsden et al., 2001). Previous studies using these tools in ASD suggested that low performance is due to low nonverbal level and/or severity of ASD symptoms (Harper-Hill et al., 2013; Williams et al., 2013, a.o.). These studies focused on adolescents and high-functioning individuals, and the specific NWR/SR tasks used contained few structures, and had predominant memory components (Riches et al. 2010, 2011; Whitehouse et al., 2008).
Objectives: With the aim of investigating structural language abilities across the spectrum, we used two experimental tasks, SR and NWR, both linguistically based, targeting structures of increasing complexity that are difficult for children with SLI. We sought to determine whether children with ASD and impaired language (ASD-LI), perform analogously to children with SLI, and whether children with ASD and normal language (ASD-LN), perform like TD children, independently from nonverbal level and ASD severity.
Methods: 15 French-speaking children with ASD (data processing for 10 additional children in progress) aged 7–11;8 (M 9;1, SD *1;9*) were administrated the SR and NWR tasks. Children varied in ASD severity (ADOS range: 4–10) and nonverbal cognitive level (WISC IRP range: 38 - 119). Standardized expressive and receptive language scores revealed children with ASD-LI (7) and children with ASD-LN (8). Comparison groups included 15 children with SLI (data for 10 additional children to be processed) aged 6;1–8;5 (M 7;6; SD *0;4*) and 73 TD children aged 4;0–8;9 (to be completed).
Results: The ASD-LI group performed analogously to the SLI group both, on SR (p=.972) and NWR (p=.084), while the ASD-LN group performed similarly to TD children on SR (when compared to TD 7-8, p=.126) and NWR (when compared to TD 5-6, p=.156). ASD-LI performed significantly worse than ASD-LN on both SR (p=.002) and NWR (p=.019).Â In the whole ASD group, a significant correlation was found between performance on SR and NWR (r_s=.575; p=.025) and between each repetition task and a composite standardized language score: SR (r_s=.890; p= .000) NWR (r_s=.643; p=.010). No significant correlations were found between SR and ADOS (r_s=-.186; p=.543) or SR and IRP scores (r_s=.513; p=.061) and between NWR and ADOS (r_s=-.450; p=.122)Â or NWR and IRP scores (r_s=.189; p=.517). No significant correlation was found between either task and age (SR, r_s=.176; p=.531; NWR, r_s=.477; p=.072).
Conclusions: Our study shows the validity of linguistically based SR and NWR tasks as markers of structural language deficits in children with ASD. Furthermore, it found that the LI/LN distinction in ASD cuts across both nonverbal abilities and ASD severity, suggesting that language can be independent in verbal ASD.

100 **107.100** Social Communication Outcomes for Young Children with Autism: A Meta-Analysis

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Background:
Deficits in social communication are a core feature of autism spectrum disorder (ASD) and are correlated with long-term language and communication outcomes (Mundy, Sigman, & Kasari, 1990; Sigman & Ruskin, 1999). As a result, improving social communication is the focus of many early interventions for children with ASD. Understanding the effectiveness of these early intervention is critical to implementing, evaluating, and improving widespread treatment plans for children with ASD.
Objectives:
The objectives of this meta-analysis were to answer the following questions: (1) Are early interventions effective at increasing social communication for young children with ASD? And, (2) do the effects of intervention differ depending on the dose of intervention, the person administering the intervention, or the age of the participants?
Methods:
A systematic review of the literature returned a total of 1,624 articles that were reviewed for inclusion. Studies were included if the study: (a) enrolled participants with ASD younger than 9, (b) used a group design that included a business-as-usual comparison group, (c) implemented a behavioral intervention that did not include a pharmacological component, (d) reported a pre-post outcome measure of social communication, and (e) was published in English.
Results:
A total of 21 studies met inclusion criteria. A standardized mean difference effect size estimate was used to account for the heterogeneous measures used across studies. A total of 996 participants were included in the analysis: 552 intervention participants and 444 control participants. The mean age of the participants was 3.34 years. The random effects model aggregated the effect sizes for an overall effect size of .521 (p-value < 0.001). These findings suggest that children in early interventions showed significantly higher initiations of social communication than children in control groups. Moderator analyses indicated that the length of intervention was not a significant moderator of outcomes (=0.02, p=0.570). Age of the participants significantly moderated outcomes, such that an increase of one year of age predicted an increase in the effect size of 0.289 (p=0.041); suggesting that older children benefitted more from the treatment. Lastly, a subgroup analysis examined the effect of the person who delivered the intervention. The largest effects were shown when the intervention was delivered by researchers (ES=1.206, Q=1.84, I^2=0%), followed by teachers (ES=0.391, Q=2.14, I^2=6.5%), a combination of researchers and parents (ES=0.373, Q=13.6, I^2=70.6%), parents alone (ES=0.321, Q=17.56 I^2=60.1%), and finally a combination of parents and teachers (ES=0.048, Q and I^2cannot be determined from one study). The only effect size that was not statistically significant at the 0.05 level in this subgroup analysis was in the case of parents and teachers as interventionists together; however, this finding is from only one study.
Conclusions: This meta-analysis indicated positive effects of early intervention on social communication for young children with ASD. An effect size of 0.521 immediately after intervention for this population characterized by deficits in this area is a notable increase. It is particularly important given the long-term benefits of social communication behaviors. Limitations of the study and implications for research and practice will be discussed.

101 **107.101** Social Communication in High School Students on the Autism Spectrum: Examining Profiles, Correlations, and Subgroups

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Background: Although all individuals with ASD have social-communication impairments, their social-communication profiles can be quite varied. A deeper understanding of social-communication characteristics and how those relate to other skills and behaviors may be helpful in tailoring intervention approaches for individuals with ASD. This knowledge could also support identifying successful pathways for community involvement and employment in the transition to adulthood. This study will examine relationships between cognitive, academic, social, adaptive, and communication skills in a large sample of high school students on the autism spectrum (n= 545) and explore potential subgroups related to social-communication skills using latent-profile analysis.
Objectives: The objectives of this study are (1) to examine the social-communication profiles of high school students with ASD, (2) to explore subgroups of high school students with ASD in relation to receptive and expressive communication, interpersonal skills, and social abilities, and (3) to examine relationships of social-communication skills with other skills and behaviors (e.g., IQ, adaptive functioning, social participation).
Methods: The participants included a sample of 545 adolescents with autism from 60 high schools in three states from the larger Center on Secondary Education for Students with Autism Spectrum Disorders (CSESA) study. Social-communication profiles were examined using three Vineland subdomains (receptive communication, expressive communication, and interpersonal relations) and the Social Responsiveness Scale (SRS-2). Other characteristics that were examined included: non-verbal IQ (Leiter-3), adaptive functioning (Vineland), and academic performance (Woodcock-Johnson-III). Additionally, the research team collected parent and teacher report of social behaviors and skills.
Descriptive statistics were used to examine the social-communication profiles. The subgroups were explored using latent-profile analysis (LPA), a person-centered analytic method that seeks to subset the members of a sample into smaller more homogeneous profiles. Correlations were used to examine relationships of social-communication characteristics with other characteristics and behaviors.
Results:
The adolescents exhibited a wide range of social-communication characteristics on the Vineland subdomains and SRS-2 (see Table 1). The LPA results indicated three subgroups. Subgroup 1 was low on all Vineland scores and high on the SRS-2; subgroup 2 was in the middle on the Vineland subdomains and the SRS-2; and subgroup 3 was high on the Vineland subdomains and low on the SRS-2. Correlations (see Table 2) revealed that communication characteristics (receptive and expressive) tended to have stronger relationships than the social characteristics (interpersonal relations and SRS-2) with cognitive and academic measures. Further, the social characteristics tended to have stronger correlations with parent and teacher reported social behaviors compared to communication characteristics.
Conclusions:
Adolescents in this sample demonstrated a very wide range of social-communication skills. However, the three groups identified by the LPA appear to represent different ranges of ability on the spectrum of social-communication rather than distinct subgroups. Results indicate that social characteristics of adolescents with ASD are more strongly associated with peer interaction and social participation than communication characteristics; therefore, interventions may need to focus more on social skills. Our results also show a relationship between technology and social-communication skills, which may support technology use during treatment. Clinical implications and alternate conclusions will be discussed.

102 **107.102** Social Impairment in Conversation: Disfluency and Compensatory Mechanisms

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Background: Social impairment is a defining clinical feature of ASD. However, little is known about how it concretely unfolds during social exchanges: how interlocutors pick up and react to disfluency, and how patterns of interaction are affected. A better understanding of the dynamics of interactions with adults with ASD will help us understand how social impairment affects the life of people with ASD and which compensatory mechanisms can be used to minimize its effects.
Objectives: We want to develop automated quantitative methods to assess dysfluency and compensatory dynamics in conversation. Using simple measures of conversational turn-taking, we ask the following questions: i) How does autistic social impairment manifest itself in conversations? ii) How does the interlocutor react? iii) Are these dynamics related to specific clinical features?
Methods: 17 ASD and 17 matched Typically Developing (TD) adults were interviewed about the details they could recall of a standardised event they had participated in. Time-coded transcripts were used to calculate turn duration, inter-turn latency, number of turns for each interlocutor and percentage of spoken time in the conversation produced by the interviewee. Mixed effects models were employed to assess the relationship between these measures and diagnosis in interviewer and participants. Finally, we assessed whether participant behavior would predict the interviewer's behavior.
Results: Participant's Behavior: There was no main effect of ASD in turn duration or inter-turn latency ($p>0.7$), but significant interaction with time: TD participants increased their turn duration over time, while participants with ASD did not (Beta= -0.13, SE=0.04, p=0.003), an effect modulated by the ADOS Communication scores as well (Beta=-0.03, SE=0.015, p=0.036). Inter-turn latency increased less over time for ASD than for TD participants (Beta=-0.01, SE=0.005, p=0.03). Severity of clinical features did not affect inter-turn latency. Interviewer's Behavior: The interviewer did not show any effect of diagnosis in contributions' length and interturn latency, but provided more turns per unit of time in conversations with participants with ASD (Beta:0.26, SE=0.05, $p<0.001$), with a median time between turns of 5.4 seconds, against 9.75 seconds with TD participants. This effect was predicted by the participant's inter-turn latency (Beta=1.4, SE=0.4, p=0.0007) and turn duration (Beta=-2.4, SE=0.64, p=0.0002), but did not interact with diagnosis ($p>.3$). This might also explain why the amount of information provided by the participants was not affected by diagnosis (Beta=-0.06, SE=0.03, p=0.07) or severity of clinical features ($p>0.5$).
Conclusions: Using simple turn-taking measures, we observe clear compensatory dynamics at work in the interviews. The more disfluency is displayed in the participant, the more the interviewer provides scaffolding. Future work will investigate whether these effects are modulated by practice and context, and how they affect the success of the interactions and the experience of the participants.

103 **107.103** Social and Communication Subtypes in Autism Spectrum Disorders (ASD) without Intellectual Disability (ID)

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Background: Individuals with ASD without ID have been understudied relative to their lower functioning counterparts even though they comprise a large proportion of those with ASD. Social and communication symptoms are particularly valuable areas of study within this population as previous research has established impairments in these areas predict functioning across multiple domains. While individuals with higher functioning ASD manifest social/communication symptoms heterogeneously, prior research using person-centered approaches (e.g., latent class analysis [LCA], cluster analysis) has demonstrated homogenous subgroups exist within this context of variability, and can be been used to predict diagnostic presentation and language development. Previous work utilizing these approaches indicates derived classes differ on age, intellectual functioning, adaptive functioning, and ASD symptomatology, though these studies were primarily done in samples with ID and/or language impairment. The present study uniquely contributes to the literature by examining social/communication impairments in a sample with ASD without ID.
Objectives: Employ an exploratory approach by using LCA to examine subtypes of social/communication symptoms in a sample with ASD without ID. Determine the variables on which derived classes differ from one another.
Methods: Participants included 367 individuals (307 males, 60 females) with ASD without ID who were verbally fluent and ranged in age from 4-28 years. Scores from 20 overlapping items in Modules 3 and 4 of the Communication and Reciprocal Social Interaction sections of the Autism Diagnostic Observation Schedule (ADOS) were used in an LCA; derived subgroups were compared on ASD symptomatology, demographic variables, intellectual functioning, and adaptive functioning.
Results: A three-class solution fit the data well and was conceptually meaningful. Classes 1, 2, and 3 comprised 43%, 29%, and 28% of the study sample, respectively. Classes significantly differed on ASD symptomatology, age $F(2,361)=12.40$,$p<.001$, full scale IQ $F(2,359)=10.37$,$p<.001$, verbal IQ $F(2,317)=14.41$,$p<.001$, and aspects of adaptive functioning (e.g., Daily Living Skills) $F(2,266)=7.41$,$p=.001$.
Conclusions: These findings indicate social/communication impairments are meaningful variables to differentiate subtypes amongst a sample with ASD without ID. They support previous research documenting considerable social/communication impairment in the context of intact intellectual functioning. Between class comparisons on variables of interest indicate overall and verbal IQ have a protective effect for some aspects of the ASD phenotype (e.g.,structural language skills) but do not protect against symptoms that are multiply determined and involve core social problem solving. Comparison of age and ASD symptomatology across classes suggests abatement of social symptoms may occur up until a certain point (i.e.,adolescence) but the rate of symptom decline decreases thereafter. Adaptive functioning (daily living skills), was strongest in the class that demonstrated the fewest language–related symptoms, a finding that supports previous work relating language skills to adaptive skill development. These findings underscore the need for more intensive social skills' intervention to promote better social outcomes and more externally valid measures of ASD symptomatology. Limitations of the current study include use of a cross-sectional design and future directions should attempt to examine longitudinal changes in social and communication symptoms across classes.

104 **107.104** Strategic Reading Comprehension Intervention for Children with ASD: Developing an Observational Tool to Identify Patterns of Active Engagement and Instructional Support

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Background:
Children with high functioning Autism Spectrum Disorder (HFASD) frequently access general education curricula but often experience reading comprehension difficulties (e.g., Nation et al., 2006; Whalon et al., 2009). It has been hypothesized that reading difficulties might be part of the expression of the social communication phenotype of HFASD (Randi et al., 2010). Thus, reading comprehension instruction may provide an important strategy to target social communication and academic skills in school-age children with ASD. Investigations identifying instructional strategies that impact student active engagement in reading instruction have important implications for children with ASD.
Objectives:
To develop an observational tool for identifying patterns of student active engagement and instructional support strategies that facilitate reading comprehension in children with ASD.
Methods:
Twenty-one children with ASD between 7–11 years (M = 8.88, SD = 1.40; 80% male) participated in an 8-week (3x per week) reading intervention targeting listening comprehension and vocabulary. Each session was video-recorded and lessons averaged 36:03 minutes (SD= 5:05). All lessons included the following activities: 1) reviewing reading rules; 2) hand signals to prompt use of cognitive reading strategies; 3) listening to a story to practice narrative comprehension; 4) answering content questions to monitor understanding; and 5) reviewing vocabulary to build background knowledge. Children completed a battery of cognitive, language, and reading measures at the beginning and end of the intervention and parents completed questionnaires about their child's social-emotional and academic development. Using the video-recorded observations and Noldus Observer® Video-Pro Software, student active engagement across three dimensions (Attention and Self-regulation, Initiating Communication, and Language Comprehension) and instructional strategies across four dimensions (Planning and Organizing, Scaffolding Questions, Supporting Comprehension, and Encouraging Participation) were coded at three time points; beginning, middle, and end of the intervention.
Results:
Preliminary results (n = 10) indicated that on average, children initiated communication 31.8 (SD = 18.21) times during the lesson; however, only 52% of these initiations (SD = 26.91) were on-topic (M = 16.1, SD = 11.55). On average, children responded to questions about instructional content 21.00 (SD = 11.45) times, with 62% (SD = 27.40) of their contributions demonstrating understanding (M = 14.2, SD = 10.34). Initiating off-topic comments (r = 0.81, p < 0.05) was positively related to Communication subscale scores on the Social Responsiveness Scale (SRS; Constantino, 2012), and challenges answering questions that require thinking or inferential reasoning (r = 0.67, p < 0.03) was positively related to SRS Total scores. After controlling for pretest scores on the Expressive Vocabulary Test (EVT-2; Williams, 2007; M = 70.20, SD = 18.49), initiating on-topic questions demonstrated a trend-level relation to expressive vocabulary measured by the EVT-2 at posttest (r = 0.95, p= 0.06).
Conclusions:
These data suggest that differences in active engagement in reading comprehension instruction may interact with individual differences in ASD related symptom intensity. These findings provide preliminary data suggesting that the tendency to initiate communication at a high rate, struggle with inferencing, and ask content-related questions about the text may moderate response to intervention in children with ASD.

105 **107.105** Talker Expectations: Top-Down Information Integration during Speech Perception in ASD

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Background: The acoustic realization of phonemes differs substantially between talkers[1]; *talker normalization* refers to the process of determining the appropriate talker-specific mapping from acoustics to phonological categories. A 2007 study[2] tested whether talker normalization involves top-down constraints or is purely signal-driven. Subjects heard words produced by synthetic talkers with identical voices save except for a 10Hz F0 difference. If subjects believed that they would hear *two talkers*, they were reliably slower in a word-monitoring task when the talker varied randomly from trial-to-trial, compared to when trials were blocked by talker. In contrast, listeners who expected *one talker* showed no slowing, indicating that expectations sufficed to trigger talker normalization. Here, we asked whether individuals with ASD would exhibit this expectation effect, in light of evidence that such individuals have reduced susceptibility to top-down expectations [3].Â
Objectives: Assess the relative influences of talker variability and top-down expectations on speech processing in ASD.
Methods: We compared adolescents with typical development (TD) (*n* = 15) and ASD (*n* = 15), matched for age (*M*=15, range=12-17 years) and IQ (FSIQ>85). Using materials from Magnuson and Nusbaum, 2007[2], participants monitored a stream of auditory words for a variable target (e.g., ball, cave). Stimuli were monosyllabic words produced by synthetic "talkers:" male voices (otherwise identical) with F0=150 or F0=160. Within single-talker condition blocks, all targets and distractors were produced by one *talker*; in mixed-talker blocks, the talker changed randomly from word to word. There was a between-subjects manipulation of expectation; given identical stimuli, some subjects were told to expect one talker with variable pitch; others expected two talkers differing in pitch. Assignment to the two expectation conditions was counterbalanced by group.
Results: Analyses included age and NVIQ as covariates. Overall accuracy was high across groups (range in the ASD group, .80-.98; TD group, .84-.97), with a trend for lower accuracy in the ASD group, *p*=.05; thus, accuracy was a covariate in subsequent analyses. Reaction time (RT), a more sensitive index of cognitive processing or load, did not differ by group, *p*=.58. There was a near-significant Group by Expectation by Block interaction, *F*(1, 23)=3.76, *p*=.06. The TD group was slower for mixed-talker blocks when they expected two talkers; when they only expected a single talker, the difference in voices did not lead to slower RT (Fig 1). The ASD group did not show this effect. While expecting to hear two talkers rather than one was associated with slower RT in the ASD group (Fig1), this effect may reflect individual RT differences in this small-n between-subjects study.
Conclusions: In TD individuals, expectations about the number of talkers influenced RT for mixed versus single-talker blocks; this effect was less apparent in the ASD group. These results suggest that speech comprehension is more signal-driven and less influenced by top-down expectations in individuals with ASD. If this finding is replicated, it could illuminate some of the conversational deficits that characterize autism.

106 **107.106** The Acquisition of Flexible Word Order and Case-Markings in Korean Children with Autism Spectrum Disorder

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Background: Researchers generally agree that the language impairments of children with ASD include pragmatic deficits (Naigles & Chin, 2015); however, less consensus exists concerning whether they also have morphosyntactic deficits. Children's productions have revealed omitted morphemes and sparse use of questions (Eigsti, Bennetto, & Dadlani, 2007; Roberts, Rice, & Tager-Flusberg, 2004); however, their *comprehension* data generally indicate intact, if somewhat delayed, grammatical understanding. However, most of the previous studies were conducted with English-speaking children with ASD, and morphosyntactic features existing in other languages such as flexible word order or case-markings have been barely studied. In Korean, case markers provide the cues to the relations between agents and patient and multiple word orders are permissible (Kim, 1997). Learning how to use both word order and case markings to interpret syntactic relations may be challenging not only for TD Korean learners, but also for Korean children with ASD.
Objectives: We used Intermodal Preferential Looking (IPL: Naigles & Tovar, 2012) to investigate Korean children's comprehension of SOV and OSV word order presented with nominative and accusative case-markers; we compare TD preschoolers with those with ASD.
Methods: Monolingual Korean-speaking TD children (n=16, *MA*=51.19months, Leiter-R Brief IQ=45.75, expressive language AE of 54~59months) and children with ASD (n=13, *MA*=70.47months, Leiter-R Brief IQ=48.00, expressive language AE of 54~66months) participated. Children viewed IPL videos, whose test sentences followed SOV ((a) A-***Nom*** B-***Acc*** Verb**)** or OSV ((b) B-***Acc*** A-***Nom*** Verb) order. The videos showed familiar actions (e.g. pushing) with agent A-patient B on one side paired with agent B-patient A on the other side; baseline trials had no directing audio. Children's eye movements were coded and two dependent variables were calculated: 'Percent looking to match' and 'Percent looking to the 1st NP as agent' during the test vs. baseline trials. Children who understand the audios will look longer to the matching scene during both SOV and OSV test trials; however, children who simply treat the 1st NP as the agent regardless of case marker will look longer to the nonmatch during OSV trials(Naigles, Kelty, Jaffery, & Fein, 2011).
Results: The TD children looked longer to the match during the test trials compared to baseline trials for SOV order (*t*(15)=2.02, *p*=.03), but not OSV order (*t*(15)=-.41, *p*=.34). With the percent looking to 1st NP as agent measure, though, the SOV/OSV comparison yielded a significant Frame effect (*F*(1, 15) = 8.78, *p* = .01). In contrast, children with ASD looked significantly *away from* the matching video during SOV trials compared to the baseline trial (*t*(12)= -2.27, *p*=.02). For OSV sentences, no significant effect was found (*t*(12)= .08, *p*=.47).
Conclusions: In sum, TD children demonstrated successful comprehension of SOV orders; moreover, they seem to pay attention to case-markers because they differentiated the OSV trials from the SOV trials. In contrast, language-matched children with ASD did not appear to make use of the case markers at all, and seemed not to understand either the canonical SOV nor OSV word order. This study suggests that Korean morphosyntax places unique challenges for children with ASD.

107 **107.107** The Development of Early Gesture-Speech Combinations in Infants at High Risk for Autism Spectrum Disorder

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Background:
Children use gestures to communicate before producing speech in the first year of life (Bates, 1976). Beginning around 14-22 months of age, children start to produce gestures with speech, conveying a sentence-like meaning (Butcher & Goldin-Meadow, 2000). For instance, a child may point to a bottle and say, "want," communicating that s/he wants a bottle. Importantly, early gesture-speech combinations are related to language skills in typical and atypical populations (Rowe, Ozcaliskan, & Goldin-Meadow; 2008). One specific population, who show deficits in gestures, is children with autism spectrum disorder (ASD). For example, Winder et al. (2013) found that infant siblings of children with ASD, who are at high risk for ASD (hereafter, "high-risk"), produce fewer gesture-speech combinations than low risk peers with no family history of ASD at 13 and 18 months. While much work has focused on exploring early gesture use in ASD, little research exists on gesture-speech combinations in high-risk infants.
Objectives:
The purpose of the present study is to expand on previous studies to examine the development of gesture-speech combinations in high-risk infants who were later diagnosed with ASD (HRA+), unaffected high-risk infants (HRA-), and unaffected low risk controls (LRC) at 12 and 18 months. Specifically, we addressed the following research questions (RQ): (1) Do HRA+, HRA-, and LRC infants show differences in gesture-speech combinations at 12 and 18 months? (2) Do early gesture-speech combinations predict infants' later language skills and/or ASD outcomes?
Methods:
73 mother-child dyads engaged in a free play for 10 minutes in the lab at 12 and 18 months (n_{HRA+} = 18, n_{HRA-} = 25, n_{LRC} = 30). Following the coding scheme developed by Özçalışkan and Goldin-Meadow (2009), we transcribed gesture and speech from videotaped sessions. We converted frequency variables to rates per 10 minutes. At 12 and 18 months, we administered receptive and expressive language subscales from Mullen and combined raw scores to calculate language scores. Also, we administered ADOS to assess infants' ASD diagnoses at 36 months. Based on ADOS and final clinical judgment, infants were categorized as HRA+, HRA-, and LRC.
Results:
RQ1: At 12 months, HRA+ infants produced significantly lower rate of gesture-speech combinations than HRA- infants (χ^2 = 6.36, p = 0.012) and LRC infants (χ^2 = 4.14, p = 0.042). At 18 months, HRA+ children produced significantly lower rate of gesture-speech combinations than LRC children (χ^2 = 6.863, p = 0.009). *RQ2:* Gesture-speech combinations rate predicted infants' language scores at both 12 and 18 months in combined HRA group ($p_{12\text{-}months}$ = 0.001, R^2 = 0.23; $p_{18\text{-}months}$ = 0.02, R^2 = 0.13), but not LRC group. Finally, total gestures rate (with or without speech) at 12 months predicted high-risk infants' ASD outcomes at 36 months, when controlling for 12-month language scores (z = -2.31, p = 0.021, R^2= 0.18).
Conclusions:
HRA+ infants produced significantly fewer gesture-speech combinations, compared to HRA- and LRC infants at 12 and 18 months. These results provide further evidence for differences in early gesture-speech combinations that predict language skills in young children.

108 **107.108** The Hands Have It: Variation in the Latency of Neural Activity during Beat Gesture-Speech Integration in ASD

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Background: Ineffective communication via speech and gesture is a primary diagnostic characteristic of Autism Spectrum Disorder (ASD). Beat gestures, which convey emphasis in conjunction with speech, are particularly likely to be interpreted abnormally in ASD. Abnormal processing of beat gestures in ASD is associated with greater activity in high-level visual cortex and less activity in planum temporale, which is active during beat gesture and speech integration in typically developing (TD) individuals (Hubbard et al., 2012). At present, however, the time course of the neural activity underlying beat gesture and speech integration in ASD is unclear.
Objectives: The objectives of this research were (1) to determine the time course of gesture-speech processing in ASD and (2) to examine how neural activity is affected by the temporal asynchrony of beat gesture. It was predicted that individuals with ASD would be less sensitive to temporal asynchrony of beat gesture and speech than their TD peers. Furthermore, it was predicted that the time course of neural activity in TD would reflect gesture-speech synchrony, whereas that the time course of neural activity in ASD would not reflect it.
Methods: Participants in Study 1 included 18 high-functioning ASD and 23 TD individuals matched in age, gender, and verbal IQ (all *p*s < .05). In this study, participants viewed a brief cartoon video and retold its events to an experimenter while being tacitly video recorded. Gestures and speech were transcribed and coded by two raters unaware of the experimental design and predictions (ICC=.79 for speech onset; .89 for gesture onset). Participants in Study 2 included 15 TD individuals. In this study, participants viewed clips excerpted from a longer video of a speech, such that a beat gesture always occurred at 1.5 s. Accompanying audio clips were presented either simultaneously with or 500 ms preceding video clips. Data was collected continuously using magnetoencepholagraphy (MEG), a neurophysiological method with high spatiotemporal accuracy, and was temporally synched to gesture onset for analysis.
Results: In Study 1, individuals with ASD produced more temporally asynchronous beat gestures than TD individuals (see Fig. 1). In Study 2, activity was observed in inferior frontal gyrus (IFG) and proximal regions between 150-300 ms after first stimulus onset (see Fig. 2). Additionally, activity was observed in posterior temporal cortex (pSTC) between 500-650 ms after first stimulus onset. Notably, this activity varied on the basis of both latency and laterality, such that greater activation in response to temporally asynchronous beat gesture and speech was associated with shorter latencies and left hemisphere. By contrast, greater activation in response to temporally synchronous beat gesture and speech was associated with longer latencies and right hemisphere.
Conclusions: Together, the results show that the latency of neural activity reflects sensitivity to temporal beat gesture-speech asynchrony and that that integration of temporally asynchronous beat gesture and speech is atypical in ASD. These results form the basis of future research examining the latency of neural activity during beat gesture-speech integration in ASD, providing insight into the neural bases of abnormal gesture-speech integration in ASD.

109 **107.109** The Impact of Bilingualism on Conversational Understanding in Adolescents with Autism Spectrum Disorders.

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Background: Bilingual families who have children with autism are often advised to use only English and not the primary language with their children in order to avoid further confusion. However, to date there is no research to support this belief. In fact, several recent studies show that bilingualism does not have a detrimental impact on language development in young children with autism. Moreover, it has been shown that bilingualism contributes to the ability to detect conversational faux-pas in typically-developing children. While conversational understanding has been studied extensively in monolingual English-speaking children with autism, to date there has been no studies examining conversational understanding in bilingual adolescents with autism.
Objectives: The purpose of the present research is to fill this gap by examining conversational understanding in three monolingual English-speaking and three bilingual English-French-speaking adolescents with autism.
Methods: To examine conversational understanding, we asked a speech and language pathologist to administer a standardized pragmatic test where our participants were first asked to identify utterances that violated conversational rules and then to provide explanations for their answers. The obtained data was analyzed both quantitatively and qualitatively. First, we analyzed the answers provided by our participants quantitatively. We then asked three independent raters to analyze the explanations provided by our participants.
Results: The results of our study show that bilingualism does not have a negative impact on the ability of adolescents with autism to detect conversational faux-pas. More specifically, we found that bilingual participants with autism examined in our study were able to detect violations of conversational rules at the same success rate as their monolingual peers with autism. Moreover, our study showed that our bilingual participants with autism were able to provide better explanations for their answers than their monolingual peers.
Conclusions: We hypothesize that a daily exposure of our bilingual participants to a richer linguistic environment could contribute to the development of more advanced linguistic, cognitive and social skills. The information provided in this study can be used to better support the needs of bilingual families who have children with autism.

110 **107.110** The Influence of Social Communication on Written Expression in School-Age, Higher-Functioning Children with Autism Spectrum Disorders

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Background: Higher-functioning children with ASD (HFASD) remain affected by social-communication impairments. However, we know little about how these difficulties affect school performance or how to leverage curriculums to improve their social-communication development. It may be that the reading comprehension and written expression problems exhibited by children with HFASD are components of the social communication phenotype of school-age HFASD and, therefore, may be important targets for school-based intervention (e.g., McIntyre et al., 2016; Randi et al., 2010; Zajic et al., in press). This study examined the hypothesis that impairments in written expression reflect an important part of the social-communication phenotype of school-aged children with HFASD.
Objectives: The study tested the hypotheses that a) 8–16-year-old children with HFASD would display specific writing impairments compared to either a clinical or a typical control sample, and b) HFASD group differences in writing performance would be significantly associated with differences in symptom severity.
Methods: The participants were 65 children with HFASD, 34 children with ADHD, and 34 children with typical development (TD). ASD symptoms were confirmed with the ADOS-2; ADHD symptoms were confirmed with the Conners-3. IQ was assessed with the WASI-II. Writing was assessed with the Word Count and Theme Development and Text Organization subscales of the Wechsler Individual Achievement Test, 3rd Edition (WIAT-III) and the Contextual Conventions (CC) and Story Composition (SC) subscales of the Test of Written Language, 4thÂ Edition (TOWL-4). Factors that may influence writing performance were assessed with the Story Memory Recall task of the Wide Range Assessment of Memory and Learning-2 and the Reading Comprehension measure of the Gray Oral Reading Test-5.
Results: A MANCOVA controlling for IQ revealed a Diagnostic Group effect on the writing measures, $F(8,242)=3.15$, $p<.002$, Wilks' $\Lambda=.898$, partial $\eta^2=.09$. Univariate effects were observed for the CC, $F(2,124)=6.44$, $p<.002$, partial $\eta^2=.09$, and for SC, $F(2,124)=10.1$, $p<.001$, partial $\eta^2=.14$. Pair-wise comparisons with Bonferroni correction indicated that the HFASD and ADHD groups performed worse than the TD group on the CC scale ($p<.002$, $p<.02$), but the two clinical groups did not differ. The HFASD group performed worse than either the ADHD ($p<.02$) or the TD group ($p<.001$) on SS, but the latter two groups did not differ. No reliable differences were observed on the two WIAT-III writing scales. ADOS-2 Total scores and TOWL-4 SC scores were correlated in the HFASD group, $r=-.39$, $p<.002$, and this association held when controlling for IQ. SC was also associated with Reading Comprehension, $r=.38$, and Story Memory, $r=.53$, $p<.001$, in the HFASD group.
Conclusions: This study revealed evidence of a syndrome-specific deficit in writing development in children with HFASD compared to clinical and typically developing controls. Differences in writing were also significantly correlated with symptom presentation consistent with the hypothesis that impairment in writing development is associated with the development of the social-communication phenotype of school-aged children with HFASD. Possible intervention implications will be discussed.

111 **107.111** The Linguistic and Cognitive Effects of Bilingualism on Children with Autism Spectrum Disorders

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Background: Parents of bilingual children with Autism Spectrum Disorders (ASD) are often advised to talk to their child using only one language to simplify the input they hear (Bird et al., 2012). This stems from the belief that bilingualism may be harmful for language acquisition in children with ASD (Kremer-Sadlik, 2005). Research concerning the language development of bilingual children with ASD is scarce, but the available evidence does not support this claim. That is, bilingual children with ASD do not exhibit additional language delays relative to their monolingual peers with ASD (Hambly & Fombonne, 2012). However, most studies have focused on initial stages of language development using parent report measures. We do not know how bilingualism impacts linguistic abilities at school age, when more complex language should be mastered. Furthermore, no previous study has investigated the effects of bilingualism on executive functions in children with ASD, and whether they may experience a bilingual advantage (Bialystok, 2007).
Objectives: In study 1, we investigated the lexical and morphological abilities of school-age bilingual children with ASD using standardized tests. In study 2, we examined the impact of bilingualism on executive functions (including set-shifting) using direct-testing and parent report of everyday executive functioning abilities.
Methods: Twenty 5- to 9-year-old children with ASD participated in the studies (10 monolinguals and 10 bilinguals) along with 20 typically-developing children. Bilingual status was confirmed by a combination of direct testing and parent report. Participants' languages included English, French, and Spanish. Children were matched on chronological age and NVIQ. Language skills were assessed using the Peabody Picture Vocabulary Test (Dunn & Dunn, 2007) and the Clinical Evaluation of Language Fundamentals (Semel et al., 2003), or their French/Spanish equivalent. Set-shifting was measured using a computerized version of the Dimensional Change Card Sort Task (DCCS; Zelazo, 2006) along with a measure of executive functioning in daily life (Behavior Rating Inventory of Executive Functioning - BRIEF; Gioia et al., 2000).
Results: *LANGUAGE:* Although both groups scored in the normal range, there was a significant difference in vocabulary ($p = .04$), where monolingual children with ASD exhibited higher scores relative to bilingual children with ASD. No significant differences were found on morphological skills ($p = .33$). *DCCS:* Bilingual participants with ASD showed better performance relative to their monolingual ASD counterparts ($p = .026$). *BRIEF:* The ASD group exhibited poorer set-shifting skills relative to the TYP group ($p < .01$). However, there where no significant differences related to bilingualism.
Conclusions: Although not presenting delays, bilinguals exhibited lower scores relative to their monolingual peers with ASD on standardized measures of vocabulary, which is likely explained by the relationship between language exposure and language proficiency (Thordardottir, 2011). We provide novel evidence that bilingualism may hold advantages for executive functioning in children with ASD, this was found for the DCCS task but not for parent report of set-shifting in daily life. These findings build on previous research suggesting that bilingualism is not detrimental for the language skills of children with ASD and in fact may provide some advantages.

112 **107.112** The Role of Sleep in Language Acquisition in Children with Autism Spectrum Disorder

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Background:
Sleep plays a crucial role in the consolidation of newly learnt language, strengthening memory traces and integrating them into existing semantic and lexical networks. Numerous studies have examined the immediate consequences of new word learning in ASD, but the nature and time course of vocabulary consolidation is currently unclear. This is particularly salient given that sleep problems are highly prevalent in children with ASD, present in up to 80% of children. These sleep problems are largely characterised by difficulties in the initiation and maintenance of sleep but emerging evidence suggests differences may also exist in the microstructure of sleep, including the extent of slow wave activity. However, the extent to which the sleep profiles of children with ASD contribute to the complex and heterogeneous language development in this population of children remains untested.
Objectives:
To characterise the time course of the consolidation of new lexical and semantic information in children with and without ASD. Additionally, to explore the role that sleep plays in the heterogeneity of these processes across children ASD.
Methods:
In an initial study 19 boys with ASD aged 7-13 years and 19 typically developing (TD) boys matched on age and receptive vocabulary were exposed to the phonological forms of 16 novel words (e.g., dolpheg). Children were tested immediately after training and 24 hours later. Explicit recall was measured via cued recall and 2AFC old-new recognition. Lexical integration was measured via a pause detection task, in which children made speeded responses about the presence/absence of a 200ms pause in the basewords (e.g., dolphin) and a set of control words for which no new competitors had been taught. Our more recent studies have addressed how children with ASD and typical peers learn and integrate new semantic information. In these latter studies children learned rare animals and then completed a size congruency task in which they made speeded judgements about the size of existing and new animal pairs. Children also underwent overnight polysomnography to capture the relationship between sleep architecture and overnight changes in memory for the new language.
Results:
Explicit word knowledge improved significantly from day 1 to day 2. There was no interaction between group and day, whereby the increase in explicit word knowledge was comparable between children with ASD and TD children. Whilst typical children showed evidence of integration after sleep (with larger increases in lexical integration correlating with greater slow oscillation activity), children with ASD did not show evidence of integration after sleep.
Conclusions:
The consolidation of explicit word knowledge appears in tact in ASD. However, there may be an aberrant time course for the integration of new vocabulary knowledge in children with ASD, which may be attributed to differences in sleep-associated memory consolidation. These results suggest that sleep difficulties may contribute to the language learning difficulties which often characterise ASD, and emphasise the importance of identifying and treating sleep difficulties in this disorder.
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113 **107.113** The Serial Relation of Theory of Mind and Functional Communication in the Externalizing Problems of Children with ASD

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Background: Previous research indicates children with autism spectrum disorder (ASD) exhibit greater externalizing problems than typically developing (TD) peers (Mahan & Matson, 2011). One factor that has been found to contribute to these greater externalizing problems is lower functional communication (FC) skills (Boonen et al., 2014). While lower FC skills may play a role in the increased externalizing problems observed in children with ASD, it alone accounts for only part of variance in this relation. Other factors related to FC, such as theory of mind (ToM), may also play a role in this well-established association. Understanding the relation among these factors is essential in determining appropriate treatment for children with ASD who have comorbid externalizing problems.
Objectives: Our objective was to develop a greater understanding of factors that may contribute to externalizing problems in children with ASD. We hypothesized that ToM abilities and FC skills would serially mediate the relation between children's status and externalizing problems.
Methods: Our sample included 111 children (ages 3:0 to 6:11) and their parents.Â Sixty-five TD children (40% female) and 46 children with ASD (21% female) were examined. Children completed a ToM battery in a laboratory setting. Parents' ratings from the *BASC-2* (Reynolds & Kamphaus, 2004) were used to evaluate children's externalizing problems and FC. The *DAS-II*(Elliott, 2007) was used to assess children's language abilities.
Results: A serial mediation model was conducted using the SPSS 24 macro PROCESS (Hayes, 2008), which provided bootstrapped estimates of the indirect effects based on 5000 resamples. Age, language abilities, and gender were controlled for in the analysis.
Results indicated status was negatively associated with ToM abilities (B = -.91, p < .05) and parent-reported FC skills (B = -7.21, p < .001). The direct effect of status on externalizing problems was also significant (B = 9.55, p < .001). Results supported the mediating role of the child's FC skills (B = 2.29, CI_{95} = .70 to 5.02) in the relation between status and externalizing problems. However, the mediating role of the child's ToM abilities was not significant (B = -.22, CI_{95} = -1.67 to .67) in the association between status and externalizing problems. The results supported a serial mediation, such that when compared to TD children, children with ASD had lower ToM abilities, which predicted lower FC skills, which was associated with greater externalizing problems (B = .25, CI_{95}= .02 to .98). This model accounted for 32% of the variance in predicting externalizing problems in our sample.
Conclusions: These results supported our hypothesis that the association between status and externalizing problems was serially mediated by ToM and FC skills. These results indicate that, compared to TD children, children with ASD may have difficulty understanding others' perspectives, as evidenced by lower ToM abilities, and this may impact their ability to communicate effectively. Lower FC skills may increase frustration and subsequently lead to greater externalizing problems. These findings suggest interventions that incorporate ToM training may not only increase FC skills, but also lead to decreased externalizing problems in children with ASD.

114 **107.114** Trajectories of Receptive Vocabulary Development from 4 to 8 Years in Children with and without Autism Spectrum Disorder: A Population-Based Study

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Background: Language difficulties are common in children with autism spectrum disorder (ASD), occurring in around 60% of children. Language difficulties can severely impact functioning and participation and result in a number of adverse sequelae such as poor academic achievement and behavioural and emotional difficulties. To date the literature has reported most children with ASD make some progress in their language ability over time. The majority of studies have used clinical samples however, and no studies have compared language development in children with ASD to children without ASD in a large population-based sample using direct standardised measures of language.
Objectives: The aim of this study was to describe trajectories of receptive vocabulary development in children with ASD compared to a large population-based sample of children without ASD.
Methods: Participants were drawn from the Longitudinal Study of Australian Children (LSAC), which is a nationally representative, population-based study. There are two cohorts of children followed in LSAC using bi-yearly direct assessments and/or questionnaires. One cohort was recruited at birth (n=4983) and the other in kindergarten (n=5107). Both cohorts were combined for the current study. Of the combined cohort, 237 children were reported by parents to have received a diagnosis of ASD by 10 years. Receptive vocabulary (Adapted Peabody Picture Vocabulary Test-III) for children with ASD was compared to children without ASD at 4 years (n=188, n=7136, respectively), 6 years (n=215, n=7297) and 8 years (n=216, n=7408). Mean trajectories of receptive vocabulary development were plotted using generalised estimating equations and compared across the two groups. The proportion of children in each group who had declining, stable and improving trajectories was also compared based on one standard deviation change as the cut point for defining the 3 different trajectory types.
Results: There was variability in individual scores for both the ASD and non-ASD groups. Mean scores at 4, 6 and 8 years were lower for children with ASD compared to those without ASD at all 3 time points (4 years ASD: 63.3 (SD 6.5), non-ASD: 64.7 (6.3); 6 years ASD: 73.2 (6.3), non-ASD: 74.1 (5.1); 8 years ASD: 77.7 (6.0), non-ASD: 78.7 (4.9)). Estimated mean receptive vocabulary scores were 0.68 units lower for the ASD than the non-ASD group across the three waves of data collection ($p=0.050$; 95% confidence interval 0.001-1.364). The estimated mean difference approached significance. There was no significant difference (chi^2; $p>0.05$ for all comparisons) between the proportions of children with ASD who had stable (ASD=54%, non-ASD=54%), improving (ASD=38%, non-ASD=35%) and declining (ASD = 8%, non-ASD=11%) trajectories. Trajectory plots of receptive vocabulary showed children with ASD progressed at a similar pace as children without ASD.
Conclusions: Receptive vocabulary trajectories were heterogeneous for children regardless of ASD diagnosis. The trajectory of receptive language development growth over time was similar across children with and without ASD, but mean scores for children with ASD were lower at each time point.

115 **107.115** Using Computational Measures of Social Communication Dynamics for Children with Autism Spectrum Disorder

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Background: Children with Autism Spectrum Disorder (ASD) exhibit impairments in social interactions and at the core of these impairments are social communication deficits. Recent advances in the quantitative and computational measurement of conversational content has resulted in a novel set of methods that might provide a more objective and reliable way of identifying the conversational biomarkers of ASD, as well as a better understanding of the time-evolving dynamics of social communication in these individuals.
Objectives: The current study has two objectives: (1) to validate the use of newly developed computational measures of conversational interaction for assessing deficits in social communication in adolescents with ASD; and (2) to further identify whether deficits in social communication are interrelated to deficits in the social motor coordination that supports effective social interaction.
Methods: Thirty children previously diagnosed with ASD completed the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2). The conversations that each participant had with the clinician during the ADOS-2 administration were evaluated using Discursis, a computational time-series method that analyzes the conceptual and semantic content of an exchange between two or more individuals. Various measures were extracted to quantify different aspects of the conversation (e.g. self-similarity, other-similarity). Additionally, measures of the child's and administrator's social motor coordination were obtained during these conversations (e.g. coherence). Of particular interest is the relationship between ASD symptom severity and the dynamical measures of communication and social motor coordination and the degree to which some of these dynamical measures better predict ASD communication deficits.
Results: Some Discursis measures were correlated with some ADOS-2 sub-category scores (e.g. social affect), as well as the composite score obtained from the test. Stepwise regressions confirmed that Discursis measures can be used to predict composite scores and traditional multiple regression showed that by including a measure of social coordination we are able to account for more of the variability present in ADOS-2 composite scores as well as some sub-category scores.
Conclusions: This data indicates that Discursis could be a sensible and important addition to our diagnostic procedures that would help us better understand the communicational deficits exhibited by some children with ASD. Furthermore, it seems that the social motor coordination that takes place during conversations is interrelated to the verbal communication and necessary to quantify for further understanding of this deficit.

116 **107.116** When "Easy" Conversations Seem Harder: Filler Words and Social Context in Adults with ASD

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Background: Social communication is a core challenge in autism spectrum disorder (ASD), but has proven difficult to reliably measure, especially in natural contexts. In this study, we use techniques from Natural Language Processing and theories of conversational dynamics to assess speech during different types of informal conversations. Speech disfluencies occur when speakers pause, revise, or add filler words to otherwise fluent speech, and may indicate problems with planning or may serve as a pragmatic tool to communicate information with interlocutors (Arnold, Fagnano, & Tanenhaus, 2003; Bell et al., 2003). Prior research shows that individuals with ASD generally exhibit higher disfluency rates than matched controls, but it is not yet known how different kinds of conversational settings affect fluency in this population.
Objectives: Compare disfluency rates, measured by filler words, in adults with ASD and typical adult interlocutors during conversations that are socially "easy" (i.e., with an interested interlocutor) and socially "hard" (i.e., with a bored interlocutor).
Methods: Â Twenty-nine adults with ASD (mean age=27y; mean IQ=104) engaged in 3-minute conversations with two different typical adult confederates as part of the Contextual Assessment of Social Skills (Ratto et al., 2011). The first confederate acted interested in the participant (Interested condition), while the second acted bored (Bored condition). Audio recordings of both conversations were orthographically transcribed. Percentage of filler words (e.g., uh, um, er, eh) relative to total words produced was calculated using Linguistic Inquiry and Word Count software (Tausczik & Pennebaker, 2010).
Results: A repeated measures ANOVA with condition (Interested, Bored) and speaker (Participant, Confederate) as within-subjects factors revealed a significant interactive effect on filler rates, $F(1,28)=8.60$, $p=.007$; Figure 1). Whereas adults with ASD produced a significantly higher percentage of filler words in the Interested condition (M=7.34%) than the Bored condition (M=6.34%, $t(1,28)=-2.42$, $p=.02$), typical confederates showed the reverse pattern, producing significantly *fewer* filler words in the Interested condition (M=5.25%) than the Bored condition (M=6.90%, $t(1,28)=2.26$, $p=.03$). Comparing filler word rates across diagnostic groups revealed no difference in the Bored condition, $t(1,28)=-.59$, $p=.56$). Significant group differences emerged in the Interested condition $t(1,28)=2.61$, $p=.01$; Figure 1).
Conclusions: Subtle language differences can influence whether social communication is successful, and examining conversational dynamics could shed light on meaningful heterogeneity in this domain. In this study, we found that rates of filler words were affected by social context in adults with ASD, with higher rates occurring during interactions that may otherwise be seen as socially "easy" (i.e., with an interested interlocutor) and lower rates when interactions are socially "hard" (i.e., with a bored interlocutor). Using more filler words during conversations with an interested partner could indicate increased responsiveness to social expectations (positive or negative), and will be clarified as we conduct the next iteration of this study on typical adults conversing with typical confederates (anticipated by May, 2017). Our findings have implications for understanding the effect of context on social communication in ASD, and may be valuable for clinicians interested in improving conversational competence in adults.

117 **107.117** Conversational Compensation Predicts Autism Symptom Severity: An Ecologically Valid Marker of Social Motivation

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Background:
Everyday conversation is often challenging for people with autism spectrum disorder (ASD), but the impact on a given individual can vary from mild to profound. In this study, we explore a behavior that facilitates social communication and could index social motivation: conversational compensation via increased word production. During natural conversation, partners engage in verbal give-and-take. When one partner reaches a lull or becomes quiet, the other partner picks up the conversational slack and "fills in the blanks". The effort expended to scaffold a conversation could serve as a naturalistic measure of social motivation that is ecologically valid and minimally affected by repeated administration.
Objectives:
Assess whether verbal compensation during natural conversation predicts symptom severity in adults with ASD.
Methods:
Twenty-nine adults with ASD (mean age=27 years; mean IQ=104) engaged in 3-minute conversations with two different confederates as part of the Contextual Assessment of Social Skills (Ratto, Turner-Brown, Rupp, Mesibov, & Penn, 2011). The first confederate acted interested in the participant (Interested condition), while the second acted bored (Bored condition). Audio recordings of both conversations were orthographically transcribed. Word counts were calculated using Linguistic Inquiry and Word Count software (Tausczik & Pennebaker, 2010) and percent change in word count from the Interested to the Bored condition was analyzed using SPSS 23.
Results:
Preliminary analyses revealed that confederates produced significantly fewer words in the Bored condition than the Interested condition ($p<.001$). Participants who produced more words to compensate for the "bored" demeanor of the confederate also had less severe behavioral symptoms as rated by an expert clinician (Pearson $r=-.46$, $p=.01$; Figure 1a). Differences in confederate word count by condition were unrelated to participant autism symptoms ($r=.007$, $p=.97$; Figure 1b). Multiple regression analysis revealed that conversational compensation by participants predicted significant additional variance in ADOS severity score after accounting for age, sex, and IQ ($\Delta F=16.05$, $p=.001$). The addition of a self-report measure of social responsiveness (SRS-SR) did not improve model fit, indicating that objective measures of conversational compensation could potentially replace self-report.
Conclusions:
Our results suggest that individuals with ASD that have less severe autism symptoms engage in "conversational compensation" to support flagging social interactions with bored interlocutors. This metric could index social motivation, and given that natural language measures avoid problems associated with subjective judgment or self-report, this measure could hold the advantage of being easily collected outside of the lab (e.g. via telephone or Skype). Quantifying such compensatory behaviors during natural conversation could shed light on the clinical heterogeneity currently complicating the search for the biological basis of ASD, and an ecologically valid metric of social motivation could serve as a treatment response indicator that taps the "essence" of ASD.

118 **107.118** Facetime Vs. Screentime: Decreased Modulation of Gaze Patterns to Live and Recorded Social Stimuli in ASD

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Background:
One of the primary characteristics of individuals with ASD is atypical eye gaze during social interactions (Kanner, 1943), but most quantitative data on how individuals with ASD explore social stimuli is based on eyetracking studies of participants watching videos. This study represents an innovative investigation into quantifiable gaze patterns of adolescents with ASD during live social interaction vs. passive viewing of recorded social information.
Objectives:
To determine whether adolescents with and without ASD modulate their gaze patterns with social context.
Methods:
Adolescents (mean age 13:6, 17 ASD, 22 TD) watched four 60-second videos of TD adolescents talking about family, hobbies, vacation, and school. ASD diagnosis was confirmed via ADOS-2 and groups did not differ on age, IQ (KBIT, IQ>80), language ability (CELF), or sex. After several distractor tasks, participants sat across a table from a research assistant (RA), answered questions on the same four topics and also formulated their own questions to the RA (Winner et al. 2002).Â We used an SMI remote eyetracker to record the percent dwell time to the face during passive viewing (video) and the live interview.
Results:
Both groups gazed longer at the video face than the live face of the RA (p = .002), indicating that individuals in both groups similarly and appropriately reduced gaze duration (i.e., less staring) when facing a conversation partner compared to watching a video.Â Gaze patterns of TD adolescents for both tasks were significantly correlated (p = .01), suggesting internally consistent gaze strategies for social stimuli. Participants with ASD did not show this correlation (p = .23). We calculated between-task difference scores for gaze duration to ascertain each person's modulation in gaze behavior as a function of task. Compared to the TD group, the ASD group showed less difference in looking time to the recorded video vs. the live interview (p = .06), maintaining similar gaze patterns for both conditions, while TD participants increased their gaze significantly more in the video task. Greater social communication impairment (SCQ) among ASD participants was correlated with decreased task-based modulation in gaze (p= .02; see Figure). The gaze patterns of TD participants were not correlated with SCQ scores.
Conclusions:
Both groups gazed longer at the video than the live person, but individuals with ASD modulated their gaze behavior less between the two tasks than TD peers. Greater social communication deficits in adolescents with ASD were correlated with increased dampening of this task-based gaze change, suggesting that reduced social insight may prevent individuals with ASD from fully modulating their gaze behavior for social stimuli. It is important to point out that the two groups differed most in gaze behavior to the *video* stimulus, not the live interaction, indicating that prior reports of significant eyetracking differences in ASD using video stimuli may not be describing the true social gaze behavior of children who have preserved language and cognitive abilities. More sophisticated and ecologically valid methods are required to quantify the foundations of aberrant social gaze during live interaction in this population.

119 **107.119** Linguistic and Prosodic Correlates of Perceived Social Skills in Conversation

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Background:
Autism spectrum disorder (ASD) is characterized by deficits in social communication, and even fluent children with ASD are often perceived by conversational partners as more socially awkward than typically-developing (TD) peers, even after very brief exposure (Grossman, 2015). However, little research has investigated how such rapid social judgments are made, nor if there are specific conversational (linguistic or prosodic) cues that are associated with such judgments.
Objectives:
To determine if specific linguistic and prosodic patterns are associated with positive or negative social perceptions of speakers during conversation.
Methods:
Thirty-four children and adolescents (mean age = 11.7 years, SD = 2.27 years) with ASD (N=12), autism (N=11), and typical development (N=11) participated in a short (2-5 minute) semi-structured conversation with an adult speaker. The first 30 seconds of each conversation were rated by a large number (M = 72.9, SD = 1.2, range=70-76) of native American English-speaking Mechanical Turk workers from 0 to 100 on five social dimensions: likability, outgoingness, social skillfulness, responsiveness, and fluency. The same 30 seconds of each conversation were transcribed and analyzed for linguistic characteristics (pauses during and between conversational turns, length and number of speech turns, errors, stutters, echoes, self-repairs, overlaps, "filler" words such as *ah, eh, em, er, oh, um*, and *like*) and robust prosodic features (median fundamental frequency (f_0), $f_0$range, and median syllable rate).
Results:
A one-way ANOVA found no differences between the ASD, autism, and TD groups on any of the five social dimensions. In fact, the ASD group was rated non-significantly higher than both the TD and autism groups on all dimensions (Figure 1). However, several linguistic and prosodic variables were associated with perceived social skills. The total amount of time that the child was silent throughout the interaction (*total pauses*) as well as the amount of time that the child was silent immediately after his partner's conversational turn (*no responses*) were strongly negatively correlated with perceptions of social skills (Table 1). Conversely, the quantity of child speech (*total speech*) was strongly positively correlated with social perceptions on all five dimensions (Table 1). Of the prosodic characteristics, median f_0 was moderately positively correlated with likability only; this relation is maintained after controlling for gender, age, and ASD diagnosis; r = 0.52 (p< 0.01).
Conclusions:
Contrary to our hypothesis, we did not find that children with ASD/autism were perceived more negatively than TD children on five social dimensions. Rather, our research suggests that conversational partners are sensitive to the *quantity* of speech and silence produced during a conversation, as well as the *timing*of such responses. These factors, which may be indicative of individual style, personality, and temperament, could drive rapid judgments of social skills more than diagnostic classification.
Table 1. Pearson's r values between language sample characteristics and perceived social skills (p < .001 for all correlations).

Â	Likable	Outgoing	Socially skilled	Responsive	Fluent
Total pauses	-0.66	-0.70	-0.74	-0.75	-0.84
No responses	-0.73	-0.70	-0.72	-0.78	-0.75
Total speech	0.56	0.68	0.67	0.74	0.66

Figure 1. Mean ratings of the three groups on five social dimensions.

120 **107.120** Reduced Phonetic Convergence in Autism Spectrum Disorder

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Background: ASD is characterized by enhanced low-level acoustic processing[1]. Little is known about how heightened low-level acoustic processing in ASD interacts with speech production and with auditory hypersensitivities. This study investigates the production of acoustic detail in speech by probing phonetic convergence, a phenomenon in which, after engaging in a cooperative sociocommunicative task, talkers tend to produce speech sounds that are more similar to their interlocutor than the same sounds produced prior to the task[2]. Previous research indicates that children with ASD are less likely to adopt speech characteristics including dialect[3], but no research to date has looked at more specific phonetic characteristics. We predicted that individuals with ASD would show reduced phonetic convergence, and that differences would be associated with social abilities and sensory sensitivities.
Objectives: Assess whether symptom severity and sensory hypersensitivity predict phonetic convergence during natural conversation in teens with ASD.
Methods: Twenty-three teens with ASD (*n*=10) and typical development (TD; *n*=13) (of a final sample of 30) engaged in 30- to 45-minute interactions with a research assistant. Participants were ages 12-18 years (*M*=15) with IQ scores (>85) and hearing abilities (pure-tone hearing screen) in the normal range. In the dyadic interaction, the "guide" directs the "tourist" to find a route on a series of six maps via verbal instructions (an opaque barrier blocked nonverbal communication). Partners alternated between guide and tourist roles. Before and after the interaction, participants and RAs produced a set of utterances designed to elicit exemplars of multiple phonemes. Exemplar recordings were subjected to acoustic measurements of voice-onset-time for /*p*/, /*t*/, and /*k*/; phoneme duration for /*s*/; centroid frequency for /*s*/; articulation rate; and fundamental frequency. Accordingly, the acoustic measurements afford examination of convergence for both temporal and spectral properties of individual speech sounds in addition to global prosodic properties. Measurements were made by a team of trained coders using the waveform and spectrogram displays in Praat to identify regions of vocal energy associated with each measurement.
Results: Analyses (ongoing) focus on phoneme duration for /*s*/. For each dyad, we calculated the absolute value of duration differences (subject minus RA) before and after their interaction. These values were analyzed via repeated-measures ANOVA, which revealed a significant group (ASD vs. TD) by time (before vs. after) interaction, $p<.05$. A correlational analysis of the difference in duration after the interaction and ASD severity (SCQ score) approached significance, $p=.08$; greater severity was associated with less convergence. Hypersensitivity on the Sensory Profile was associated with less convergence, $p=.03$.
Conclusions: Given strengths in auditory processing, one might expect heightened sensitivity to phonetic qualities in ASD. Instead, dyads including teens with ASD were less likely to modulate phonetic qualities to conform to interlocutors compared to TD teens. Lesser convergence was associated with symptom severity (weakly) and with sensory hypersensitivities. Prior research[2] suggests that socially influential participants show more convergence than less influential ones; these preliminary results suggest that phonetic convergence is socially complex, and reflect not just auditory processes but also social influence.

121 **107.121** Animating Characters and Experiencing Others: A Look at Peer Groups' Storyboard Narratives

***K. Bottema-Beutel**, Lynch School of Education, Boston College, Boston, MA*

Background: Individuals with autism spectrum disorder (ASD) are thought to be impaired in narrative abilities, especially those related to perspective taking (Colle, Baron-Cohen, Wheelwright, & van der Lely, 2008). The most prominent account for these difficulties is that individuals with ASD lack a Theory of Mind (e.g., Baron-Cohen, 1995). However, more recent 'enactive' approaches situate an understanding of others as an embodied interactional practice, rather than as an abstract process of mind-reading (De Jaegher, 2013; Gallagher & Hutto, 2008).
Objectives: This study combined enactive theoretical accounts of perspective taking with Discourse Analysis in order to examine the construction of fictional narratives ('storyboards') within small adolescent social groups, where at least one member of the group was diagnosed with ASD.
Methods: . The data corpus was comprised of 7 hours of video recordings, which featured 9 adolescents with ASD and 19 neurotypical peers, divided into groups of 4-6 adolescents. The data was collected during a team building workshop at a summer camp. Social groups were given a set of photographs of previous workshop or camp activities, which depicted group members, campers, camp administrators, and others at camp. They were instructed to create a storyboard using at least 10 photos. Videos were transcribed using conversation analysis conventions (Atkinson & Heritage, 1984). Transcripts were coded for instances where the perspective of the developing characters, author, narrator, or audience was made relevant. Fine-grained analyses of extended stretches of talk were then conducted in order to determine the ways in which story characters and the larger narrative were constructed through discourse.
Results: Two major findings emerged that reflected participants' perspective taking abilities. First, participants indirectly referenced story character's mental lives by offering contextualized descriptions of characters' actions. There was variation in the extent to which action descriptions linked to mental states; action descriptions could *entail, imply, or index* character mental states (see Table 1 for transcript extracts and descriptions). Second, participants relied on the enactment of *genre conventionsÂ* when constructing their narratives as a means to meet the expectations of the presumed audience.Â This strategy allowed participants to circumvent anticipating or 'mentalizing' about the expectations of a particular audience, and instead apply generic fidelity criteria that would presumably be recognized by a broad, hypothetical audience. Participants'' drew upon genre conventions related to plot structure, character identities (e.g., villains and heroes), and the physical layout of the storyboard. In keeping with previous discourse analytic work in ASD, this reflected 'socio-cultural' perspective taking (Ochs et al., 2002).
Conclusions: This study illustrates two ways that adolescents with ASD engaged in perspective taking when constructing fictional narratives with peers: describing character actions and enacting genre conventions. These findings suggest that narrower approaches to identifying perspective taking abilities in individuals with ASD, especially those that restrict analysis to the word level (e.g., tallying the number of mental state terms used in a narrative retelling) may not capture the full range of narrative or perspective taking abilities in which individuals with ASD can engage.

Poster Session
108 - Genetics
12:00 PM - 1:40 PM - Golden Gate Ballroom

122 **108.122** Age at First Birth Has Genetic Determinants and Is Related to Social Responsiveness

***M. Vysotskiy**[1], I. Mitra[1], M. Traglia[1], L. A. Croen[2] and L. Weiss[1], (1)Department of Psychiatry and Institute for Human Genetics, University of California San Francisco, San Francisco, CA, (2)Kaiser Permanente Division of Research, Oakland, CA*

Background: The age at which parents of both sexes have children has been associated with increased risk of autism spectrum disorders (ASDs). Though the reasons for this are unknown, they are often hypothesized to be due to chromosomal changes in eggs and *de novo* mutations in sperm. An alternative mechanism has been speculated that subclinical ASD-like behaviors lead to delayed childbearing. Social aptitude (measured as Social Responsiveness Scale score, SRS) is heritable and closely related to ASDs. It has been observed that, on average, parents of children with ASDs have lower social responsiveness. This leads to a hypothesis that the age a parent has a first child (age at first birth, ageFB) is not a causal risk factor for ASDs, but instead, parental social responsiveness may influence ageFB and ASD risk separately. As SRS is highly heritable, these effects are likely mediated by genetics.
Objectives: The study aimed to clarify the nature of the relationship between ageFB and ASD risk. We used genome-wide genetic data from several ASD datasets to measure the heritability of ageFB and assess the relationship between ageFB and SRS. These data were additionally used to identify common variants associated with both traits.
Methods: In order to estimate the genetic component of ageFB, the heritability of the trait was measured in the Early Markers for Autism (EMA, N=333 primiparous mothers of cases and controls) dataset and Simons Simplex Collection (SSC, N=1,580 trio parents) dataset. Correlation between ageFB and SRS, as well as a GWAS of SRS, were performed in the SSC for both parents. A GWAS of ageFB was performed as a meta-analysis across the EMA, SSC, and part of the Autism Genetic Resource Exchange (AGRE) datasets (N=3,855).
Results: In SSC parents, adjusting for genetic ancestry, sex, and educational attainment, ageFB was found to be significantly heritable ($P<5.8x10^{-4}$). Correlation between ageFB and parental SRS in SSC was significant in a similarly adjusted model ($P<2.2x10^{-16}$). The top ageFB locus ($P=9.1x10^{-11}$) fell near the *ASTN2* gene, close to an ASD candidate gene identified by the Psychiatric Genomics Consortium (PGC) and implicated previously in ASDs based on analysis of rare variants. The ageFB loci identified in ASD parents show several overlapping loci with published population-based ageFB studies. Further, one of the top loci associated with SRS in ASD parents was a population ageFB locus, suggesting the relationship between social aptitude and ageFB is likely to generalize beyond ASD families.
Conclusions: This study of parents of children with ASDs finds that ageFB appears heritable and correlated with SRS. Furthermore, both traits have associated genetic variants, with overlap between loci associated with ageFB, SRS, and ASDs. The relationship between ageFB and SRS supports a hypothesis that the link between parental age and ASD risk in offspring is mediated through the genetics of social responsiveness. Because the parental behaviors leading to delayed childbearing are heritable, these traits may present themselves as ASDs in offspring. The information gained from our study can help parents make informed decisions.

123 **108.123** Assortative Mating in Autism Spectrum Disorder

S. Connolly[1], *R. J. Anney*[2], *L. Gallagher*[3] *and E. Heron*[4], *(1)St James, Trinity College Dublin, Dublin, Ireland, (2)Cardiff University, Cardiff, United Kingdom, (3)Trinity Centre for Health Sciences, Institute of Molecular Medicine, Dublin, IRELAND, (4)Trinity College Dublin, Dublin, IRELAND*

Background:
Assortative mating is a non-random mating system in which individuals with similar genotypes and/or phenotypes mate with one another more frequently than would be expected in a random mating system. Autism Spectrum Disorder (ASD) is considered to be a heritable neurodevelopmental disorder and when investigating the genetic components of ASD, random mating is assumed, although this may not necessarily be the case. The prevalence of ASD has increased from 4 in 1000 in the early nineties to a more recent estimate of 1 in 68 children aged 8 in the US. This increase in prevalence is due to many factors such as increased awareness and diagnoses but it has been hypothesised that some of this increase in prevalence is due to assortative mating.
Objectives:
Assortative mating can be explored through both phenotypic and genotypic data, although it has never been investigated through genotypic measures in ASD. The objectives here are to investigate evidence of genetic assortative mating between ASD parents.
Methods:
We investigated whether or not there is evidence of excess of genotypically similar mating pairs using genome-wide Single Nucleotide Polymorphisms (SNP) data on trio families (Autism Genome Project (AGP) data (1,650 family trios) and Simons Simplex Collection (SSC) data (1,962 family trios)). Determining whether an excess in genetic similarity was present or not was explored through kinship coefficients and spousal correlation between the principle components in both the AGP and SSC datasets.
Results:
We found evidence of assortative mating in the AGP data using both methods. There was no significant evidence of assortative mating using the kinship coefficients in the SSC data. Although, there was significant evidence when investigating assortative mating using correlation between the principle components in the SSC dataset.
Conclusions:
Although both the AGP and the SSC show evidence of assortative mating when exploring the correlation of the principle components, the AGP shows further evidence of assortative mating when investigating genetic similarity of parents of ASD offspring using kinship coefficients. Therefore, this stronger evidence of assortative mating in the AGP (contains mulitplex and simplex families) compared to the SSC (strictly contains simplex families) reflects the differences that have previously been observed between multiplex ASD families and simplex ASD families (Klei et al. 2012, Chaste et al. 2012).

124 **108.124** Atypical Neural Sensory Processing of Auditory Stimulus Change Among Children with De Novo Disruptive Mutations to SCN2A

T. DesChamps[1], *B. E. Cairney*[2], *C. M. Hudac*[3], *R. Ma*[4], *A. S. Wallace*[2], *V. Troiani*[5], *A. S. DiCriscio*[6], *C. M. Taylor*[7] *and R. Bernier*[2], *(1)University of Washington, Seattle, WA, (2)University of Washington Autism Center, Seattle, WA, (3)Psychiatry & Behavioral Sciences, University of Washington, Seattle, WA, (4)Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle, MA, (5)Geisinger-Bucknell Autism & Developmental Medicine Institute, Lewisburg, PA, (6)Autism & Developmental Medicine Institute, Geisinger Health System, Lewisburg, PA, (7)Geisinger Health System, Lewisburg, PA*

Background: Recurrent gene disrupting mutations are implicated in 10% of autism spectrum disorder diagnoses (Iossofov et al., 2014). Based on such findings, promising “genetics-first” approaches characterize ASD phenotypes based on known genetic etiologies to parse heterogeneity (Stessman, Bernier, & Eichler, 2014). Unique phenotypic patterns of genetically-defined subtypes have emerged (e.g., *CHD8,* Bernier et al., 2014). Disruptive mutations to the voltage-gated sodium channel alpha subunit *SCN2A* are implicated in ASD (Weiss et al., 2003; Sanders et al., 2012) and may represent a unique ASD-related phenotype (Tavassoli et al., 2014). Common ASD behaviors such as atypical behavioral responsivity to sensory stimuli (Liss et al., 2006) are observed in human carriers of *SCN2A* (Tavassoli et al., 2014) and *Scn2a* mouse models (Kearney et al., 2001) suggesting that impaired low-level sensory processing may be associated with the *SCN2A*phenotype.
Objectives: Characterization of the phenotype associated with disruptive *SCN2A* mutations is critical to understanding genotype-phenotype relations and illuminating the pathophysiology of ASD in genetically defined subgroups. This study aims to contribute to a fuller description of the *SCN2A* phenotype by examining neural correlates of sensory processing.
Methods: Children with *de novo* mutations to *SCN2A* and their biological siblings participated in an auditory oddball event-related potential task measuring low-level sensory processing of auditory stimulus change. To date, participants included children with *de novo SCN2A* mutations (*n* = 8, 5 male, 5 ASD, mean age = 10.77, range = 5.75 - 15.58) and their biological parents (*n* = 17,Â mean age = 43.35, range = 35.0 – 51.25*),* siblings (*n* = 5, 3 male, mean age = 9.18, range = 4.58 - 17.58). *ERP Paradigm:*Standard pure tones (82%), and deviant tones varying in duration (6%), frequency (6%), and combined duration and frequency (6%) were presented during passive viewing of a silent movie. Responses to deviant tone types were averaged together. Peak latency of the P3a component were extracted from frontocentral medial electrodes.
Results: Preliminary analyses were conducted in SAS 9.4 using multilevel models tested condition and group differences. A random-intercept single-trial analysis was utilized to account for ongoing variance across the session. All groups exhibited a faster P3a latency to deviant compared to standard conditions, $F(2, 32000) = 149.65$, $p < .0001$. A group by condition interaction on P3a peak latency, $F(2, 32000) = 21.39$, $p < .0001$, indicated that SCN2A carriers had less condition discrimination (diff = 3.56 ms, $p = .0033$) than parents (diff = 11.12 ms, $p < .0001$) or siblings (diff = 6.01 ms, $p < .0001$).
Conclusions:
Compared to non-carrier relatives, *SCN2A* carriers exhibited reduced neural discrimination between standard and deviant tones as measured by P3a latency. This finding suggests diminished sensory sensitivity to auditory stimulus change among *SCN2A* carriers and a potential reduction in bottom-up regulatory systems that are critical for attending to and integrating information in the environment. Future efforts to characterize the *SCN2A* phenotype will examine relationships between atypical sensory processing and behavioral features.

125 **108.125** Autism and Obesity: Assessing Antipsychotic-Induced Weight Gain and BMI Associated SNPs

Z. Talebizadeh[1]*, A. Shah*[1]*, J. Noel-MacDonnell*[1]*, H. Dai*[1]*, J. N. Constantino*[2] *and D. J. Mueller*[3]*, (1)Children's Mercy Hospital, Kansas City, MO, (2)Department of Psychiatry, Washington University School of Medicine, St. Louis, MO, (3)Centre for Addiction and Mental Health, Toronto, ON, Canada*

Background: A *general assumption* is that the observed elevated rate of obesity in autism (i.e., 40%) is caused by antipsychotic-induced weight gain (AIWG). It is not clear if obesity is co-occurring with autism or is related to AIWG.
Objectives: Our hypothesis is that the prevalence of known AIWG associated SNPs in obese and non-obese autistic subjects is comparable; thus, AIWG cannot be the only reason for the observed higher rate of obesity. To test this hypothesis, we evaluated the prevalence of AIWG associated SNPs in obese and non-obese autistic subjects.
Methods: We curated a list of about n=150 SNPs with at least one report of association with AIWG. We assessed phenotypic and genotyping data (three Illumina platforms) from Simons Simplex Collection (SSC). We analyzed genotyping data for n=115 AIWG SNPs from > 2000 probands from SSC. BMI data on probands was used to identify obese and non-obese subjects (> 1000 probands met the applied BMI cut off for each weight category). Similarly, we evaluated unaffected SSC siblings (> 2000) stratified to obese and non-obese groups.
Results: Â **AIWG SNPs analysis.** (1) Only one out of 115 AIWG SNPs (rs7702361) achieved an FDR corrected significant p-value, comparing obese versus non-obese autistic subjects. (2) No difference was found for rs7702361, comparing obese versus non-obese unaffected siblings. (3) Current medication history data (i.e., Attention Deficit-ADD medication and Mood Stabilizers) were used to assess the potential medication effects on obesity in probands. Analyses were run separately for probands stratified by medication use (e.g., Mood Stabilizers “Yes” or “No”). The rs7702361 SNP showed an association with both Mood Stabilizers “Yes” or “No” subsets and none with the subjects on ADD medication; suggesting that the detected association of this SNP with obesity category in probands is more likely independent of drug exposure and may be related to the underlying condition (i.e., co-occurring autism and obesity). Comparing obese probands stratified by Mood Stabilizers use (i.e., “Yes” versus “No”) did not detect any differences for rs7702361, which further validates the above conclusion about the potential association of this SNP with the underlying co-occurring conditions not drug exposure. **BMI SNPs analysis.** Similarly, we evaluated genotyping data for n=74 BMI SNPs for SSC subjects. This analysis showed both shared (i.e., familial BMI/obesity risk factors) and distinct BMI associated SNPs in probands and siblings, which may indicate potential differences in the underlying mechanism of obesity in autistic and non-autistic family members. This observation further complements/strengthens our finding for the AIWG SNPs.
Conclusions: Â Our results suggest that factors beyond drug side effect may contribute to the observed higher rate of obesity in autism. Furthermore, an association with rs7702361 (located in the RXFP3 gene, ch5p13.2) in autistic subject with obesity was found, which appears to be independent to anti-psychotic medication use. It is intriguing that recent reports highlight the importance of this gene and related networks in neuropsychiatric disease and eating disorders. Further investigations are warranted on the potential role of the RXFP3 gene in association with co-occurring autism and obesity.

126 **108.126** Chemical-Gene-Disease Interaction Analysis Reveals Overlaps Between Autism and Cancer

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Background:
Published research increasingly supports the contribution of environmental factors such as toxicants and nutrients to Autism Spectrum Disorders (ASDs). Finding associations between chemicals and ASDs can provide a starting point for investigation of possible mechanisms by which these substances may contribute to ASDs and their features.
Objectives:
We set out to generate informatics-based data linking autism-associated genes and autism-associated chemicals and substances in order to provide insight into the underlying molecular means by which environmental factors influence ASDs.
Methods:
We used a well-established chemical-gene-disease database, Comparative Toxicogenomics Database (CTD), as our data source to investigate gene-chemical interactions in relation to ASD-associated chemicals.Â 1) We used the MeSH term “Autism Spectrum Disorder” as a search term under the “Disease” category in CTD.Â Under the “Chemical” sub-category for ASD, we chose the chemicals that have a curated association to the disorder, which means that the chemicals have been reported to be related to ASDs by what CTD categorizes as “direct evidence.” 2) Then, for each ASD associated chemical, CTD’s “top 10 interacting genes” were used in further analysis. Some chemicals had less than 10 interacting genes, in which case all genes noted in this CTD category were used. 3) We pooled all the top genes for every selected chemical and used the Gene Set Analyzer tool provided within CTD to perform a gene set enrichment analysis to identify enriched pathways and gene ontologies. 4) Some of the genes interacted with more than one ASD substance; we tabulated the number of substances with which each gene interacted and ranked the genes by this number.
Results:
16 substances were found to be associated with ASDs by presently available direct evidence: Valproic Acid, Arsenic, 5-Methylcytosine, 5-hydroxymethylcytosine, Testosterone, Serotonin, Air Pollutants, Lead, Zinc, 8-oxo-7-hydrodeoxyguanosine, Triiodothyronine, Cadmium, Magnesium, Mercury, Aluminum, and Androstenedione. A total 109 genes that interact with these chemicals were investigated. The enrichment analysis found that these genes were enriched for pathways “Pathways in Cancer” (p-value 5.03e-16) from pathway database KEGG; and “Metabolism” (p-value 1.01e-18), and “Signal Transduction” (p-value 6.57e-15) from pathway database REACTOME. The Gene Ontology enrichment analysis found that these 109 genes were enriched for “Response to Chemical” (Biological Process, 4.92e-62) and “Binding” (Molecular Function 4.04e-33). The most impacted genes with most number of interactions with ASD chemicals/substances were: a*) CASP3, CYP1A1, HMOX1, MT1, PTGS2*, and *TNF*, each with 4 interactions; and b) *CAT*, and *MAPK3*, each with 3 interactions.
Conclusions:
The gene enrichment findings for KEGG “Pathways in Cancer” and for REACTOME “Metabolism” suggest overlaps between ASDs and both cancer and metabolism. All of the most impacted genes listed above are also associated with cancers. The ASD-cancer overlap, while previously reported, is derived here from chemical-gene interactions—a new source. The enriched GO categories “Response to Chemical” and “Binding” – together with the enriched REACTOME pathway “Signal Transduction” – are cellular reactions that process “environmental information.” Our results suggest that information processing procedures may play a mechanistically crucial role in environmental contributions to ASDs.

127 **108.127** Clinical Characterisation of Neurexin1 Deletions and Their Role in Neurodevelopmental Disorders

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Background:
The Neurexin1 (NRXN1; 2p16.3) gene has been identified as a rare but significant genetic risk factor for a number of neurodevelopmental disorders including autism spectrum disorder (ASD), schizophrenia, intellectual disability and bipolar disorder. NRXN1 encodes neurexins, presynaptic neuronal adhesion molecules that bind to postsynaptic neuroligins to stabilise synapse formation and facilitate neuronal transmission. Common clinical features are associated with NRXN1 deletions but these have not been deconstructed using in-depth neuropsychological, neurocognitive and neuroimaging techniques.
Objectives:
This collaboration aims to use a multi-modal approach to deep phenotype individuals and characterise the clinicopathological features of NRXN1 deletions in order to establish diagnostic biomarkers and targeted therapeutic interventions.
Methods:
To date, 19 families (n = 31) identified with NRXN1 deletions have been recruited. Participants completed a battery of semi-structured neuropsychological assessments (CAPA, PAS-ADD) and questionnaires to probe for existing and/or sub-threshold psychiatric disorders or symptoms. The WASI-II and a comprehensive cognition battery (CANTAB) which, included tests of reaction time (RTI), attention (MTS, RVP), executive functioning (SOC), working memory (SWM), cognitive flexibility (IED) and social cognition (ERT), was administered to assess neurocognitive functioning. Abnormal brain structure and function was investigated using MRI. High-resolution T1, diffusion, spectroscopy and resting state data was collected. Structural T1 and diffusion data have been analysed using FSL (TBSS/VBM) and ExploreDTI software. Age and gender matched controls were used to explore preliminary findings.
Results:
Clinical assessments indicated that of the 31 individuals with NRXN1 deletions, 14 met criteria for ASD, 8 for ID (3 mild ID and 5 severe ID), 3 for ADHD, 3 for an anxiety disorder, 1 for a psychotic disorder and 1 for conduct disorder. The NRXN group (n=15) had significantly lower IQ scores than the control group (n=9), ($t(22) = -3.272$, $p = 0.004$). Neurocognitive assessments indicated that the NRXN group performed significantly poorer on tasks of attention (MTS; $t(22) = -2.263$, $p = 0.011$), executive functioning (SOC; $t(22) = -2.940$, $p = 0.005$), cognitive flexibility (IED; $t(22) = 1.863$, $p = 0.047$) and social cognition (ERT; $t(22) = 2.168$, $p = 0.032$). TBSS results indicated that that there was lower FA in the NRXN group relative to the control group in the body of the corpus callosum, the inferior longitudinal fasciculus and the posterior radiate trending towards significance. VBM results revealed no difference in grey matter volume between the groups. The remaining individuals were either too low functioning or too young to complete assessments.
Conclusions:
Although the study data are preliminary, interesting clinical characteristics of NRXN1 deletions are emerging. Psychological assessments indicate a clear link between the presentation of clinical symptoms and a NRXN1 deletion. Neurocognitive testing illustrated that poor attention, executive dysfunction and reduced social cognition are most characteristic of individuals with NRXN1 deletions. Furthermore, disrupted white matter organisation may potentially be established as a neuroanatomical phenotype underpinning the clinical and cognitive deficits observed. Additional clinical and neurobiological phenotyping in large numbers of individuals with NRXN1 deletions in addition to mapping of the NRXN1 genotype may elucidate the underlying neurobiological processes contributing to neurodevelopmental disorders.

128 **108.128** Comparison of Phenotypic Severity Associated with Autism Risk CNVs in Clinically Identified Samples of High Functioning Males and Females

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Background: Clinically identified samples of ASD typically exhibit a male:female sex ratio > 4:1. Many genetic studies report females possess a greater genetic 'burden' and substantially lower IQ than males with an equivalent phenotype (SFARI Foundation Autism Research Initiative). Current estimates point to 10-20% of ASD being caused by Copy Number Variants (SFARI database). It is not known whether apparently large sex differences in ASD prevalence (especially in normal/high IQ samples) reflect a failure of ascertainment of 'high functioning' females, rather than any substantial differences in genetic risk, as measured by the burden of CNVs.
Objectives: To investigate in a 'high-functioning' sample of clinically identified autistic children, with IQs in the normal/high range, the impact of ASD-risk CNVs (as compiled by SFARI) on ASD symptoms and cognitive abilities. To compare and contrast male and female phenotypes in those with and without 'pathogenic CNVs'. To test the hypothesis that females with pathogenic CNVs have more severe phenotypes than males with equivalent genetic risk.
Methods: Subjects were consecutive referrals to the National Centre for High Functioning Autism in London, UK. The autistic traits of 253 participants with autism were measured using a standardized interview (ADI algorithm) and the Autism Diagnostic Observation Schedule (ADOS). IQ was tested with the Wechsler Intelligence Scale for Children-IV (UK). Salivary or buccal cells were collected from the participants for DNA extraction. The microarray analysis carried out in the North East Thames Regional Genetics Laboratory was applied on Affymetrix 750K oligo SNP array. Ratio plots generated by infoQuant Fusion v6 software to show the copy number losses or gains were analysed with an electronic reference file, supplied by Affymetrix, which was based on averaging the results from 1000 sex-matched individuals from 4 major ethnicities.
Results: We compared male:female phenotypes in terms of ADI algorithm scores, ADOS algorithm scores, and IQ subscales. The mean verbal IQ of females with no pathogenic CNV was 91.7 (SD 20.6); that of females with a pathogenic CNV was 104.2 (SD 19.9). Comparing males and females without CNVs (233), no significant gender differences were found in terms of severity of phenotypes, in any domain of the ADI, ADOS, or IQ subscale. In those with pathogenic CNV (20) the effect sizes of gender differences in ADI algorithm scores were in the range 0.03-0.6, with females tending to show more severe phenotypes in social interaction and repetitive/stereotyped behaviours. On all ADOS subscales, the rated phenotype was more severe in males (effect sizes in range 0.4 – 1.4). In the sample with a pathogenic CNV, verbal and performance IQ were higher in females than males (effect sizes in range 0.5-0.6). CNV burden was no greater in females than in males.
Conclusions: There has been a probable ascertainment bias in recruitment studies, leading to erroneous conclusions about the impact of pathogenic ASD-related CNV in females. Females with ASD who are at genetic risk, but who have normal/high range IQ, are being missed by clinical research methodologies. They have milder phenotypes than males when assessed by standardized observation.

129 **108.129** Creatine Transporter Deficiency: A Rare Neurodevelopmental Disorder with ASD Symptomatology

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Background: Creatine transporter deficiency (CTD) is a rare X-linked inherited neurometabolic condition associated with intellectual disability, minimal verbal development and, in some cases, ASD. Seizures are also common. CTD is caused by mutations in the SLC6A8 gene, and was discovered in 2001. It is estimated that 0.2% to 3.5% of males with Intellectual Disability or Autism Spectrum Disorder (ASD) may have CTD (Thurm et al., 2016). Unfortunately, CTD cannot be identified through microarrays, which are commonly ordered for children with ASD. Like other genetic conditions associated with ASD characteristics, it is important to increase identification and to understand the behavioral phenotype, as these children may have a distinct developmental trajectory.
Objectives: The objective of the study was to understand the potential relationship between CTD and ASD with regard to identification, characteristics, and developmental course.
Methods: We studied 20 children and adults with CTD, ages 1-21 years, through parent interviews, questionnaires, medical records and direct testing. Parent interviews were relatively unstructured but were informed by our familiarity with the ADI-R. We asked about first concerns, concerns in hindsight, the path to diagnosis, and parents' top current concerns. We administered the Vineland Adaptive Behavior Scales, Social Communication Questionnaire (SCQ) and Aberrant Behavior Checklist (ABC) to all 20; the Mullen Scales of Early Learning to seven (some of whom were older than 60 months).
Results: Â Six participants had a documented diagnosis of ASD in addition to CTD. One participant had a biological sibling with ASD, but not ASD himself.Â The quality of early concerns was not different between children with CTD+ASD or CTD alone. Across the entire group, parents' first concerns were most often about delayed speech or motor milestones (most often walking, but sometimes crawling). In hindsight, parents reported high rates of vomiting in the first year of life (66%). Across the entire group, the average SCQ was 20.8 (range 10-34), with 16/20 (81.25%) individuals scoring 15 or higher. ABC average Irritability domain score was 17.6 (range: 4-38). Vineland and Mullen scores were generally in the very low ranges such that it would be difficult to calculate mental ages accurately. Even with high SCQ scores, parent top concerns were: language, negative behaviors, independence skills, attention, and emotion regulation. Most individuals with CTD continue to struggle with basic self-help skills such as dressing and bathing, but parents did not describe the social aloofness or withdrawal often seen in severely impaired children with ASD.
Conclusions: As new genetic disorders are discovered, it will be important for ASD researchers and clinicians to consider whether they have undiagnosed individuals in their caseloads or samples. Individuals with CTD are likely to have a different developmental trajectory and diminished response to behavioral treatment than most children with ASD. While not universal, possible signs of CTD include minimal verbal development, a history of delayed crawling or walking, vomiting during the first year of life, and possible seizures. Challenging, attention-seeking behaviors are also common. Referral to a metabolic geneticist is important for both diagnosis and treatment.

130 **108.130** Developmental Markers of Genetic Liability to Autism in Parents: A Longitudinal, Multigenerational Study

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Background: Genetic liability to autism spectrum disorder (ASD) can be expressed in unaffected relatives through subclinical, genetically meaningful traits, or endophenotypes. To date, investigations of ASD endophenotypes in parents have necessarily been restricted to assessments administered in adulthood, when status as a parent of a child with ASD is determined. This leaves unexamined a large swath of time during which ASD endophenotypes are likely to first arise, and might be most profitably studied for clues into underlying biology. This study aimed to identify developmental endophenotypes in parents of individuals with ASD by examining parents' childhood academic development over the school-age period, using archival standardized testing records from kindergarten-high school. Parents' childhood developmental profiles were examined in relationship to endophenotypes in adulthood, and ASD symptom expression in the next generation.
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Objectives: To identify developmental endophenotypes in parents of individuals with ASD using archival testing data from childhood.

Methods: A cohort of 139 parents and their children with ASD, and 28 adult controls participated. Archival records of standardized test performance in the domains of language, reading, and math were examined from grades K-12. Additionally, a battery of cognitive, language and personality measures were administered to parents. ASD symptoms in children were measured using the gold-standard diagnostic measures for children with ASD. Parents' performance over time was examined relative to controls as well as in relationship to clinical-behavioral endophenotypes in adulthood, and their children's ASD symptoms.
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Results: Subtle differences were observed in the language domain, with the ASD parent group showing lower language skills than controls overall. Additionally, relatively slower development of language and math skills, and a fractionated, or uneven rate of development across domains in the ASD parent group predicted ASD endophenotypes in adulthood for parents, and increased symptom severity in their children diagnosed with ASD.
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Conclusions: Results identified developmental profiles in parents of individuals with ASD that are related to endophenotypes measureable in adulthood among parents, and ASD symptom severity in parents' offspring. Evidence of such early expression of genetic liability, in patterns of academic performance across major curricular domains of language, reading, and math (and perhaps language in particular), a generation removed from affected individuals, may help to advance neural and genetic research by stratifying individuals and families to examine biological factors differentially associated with genetically meaningful developmental phenotypes in parents.

131 **108.131** Differential Alternative Splicing in Superior Temporal Gyrus of Autism Spectrum Disorders Brains

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Background: Gene expression studies in postmortem brain in Autism Spectrum Disorders (ASD) have revealed dysregulated immune and neuronal networks. Differential alternative splicing (DAS) in genes targeted by the neural-specific splicing regulator FOX1 (A2BP1) has been reported in ASD brain. Thus, we investigated genome-wide DAS in superior temporal gyrus (STG) of brains of ASD subjects compared to typically developing (TD) controls. STG is an association cortex involved in social perception, joint attention, face perception and speech perception and is implicated in ASD.
Objectives: To assess DAS in the STG transcriptome in postmortem human brains of ASD subjects compared to TD controls.
Methods: RNA libraries from 45 subjects (16 ASD, 14/2 M/F and 29 TD, 23/6 M/F) were sequenced to 40M 2×150 bp reads using Illumina sequencing-by-synthesis technology. Alignments to the human genome (hg19) (STAR 2.4.1d aligner) and quantification using the Ensembl 75 transcript database were performed. DAS was assessed using Log-normal with shrinkage models as implemented in Partek Flow, considering Diagnosis (ASD, TD), Sex (F, M) and Age (continuous variable). Gene-Specific Algorithm (GSA) was applied to each transcript separately to identify factors and interactions that affected DAS. After filtering low expressing transcripts, DAS between the groups was considered significant with |Fold-Change| >1.2, and FDR-corrected p<0.3 (nominal p<0.01). Gene Ontology and Ingenuity Pathway Analysis were used to identify relevant biological functions.
Results: There was no significant age difference between ASD (Average age: 30 years, range 9-56)) and TD (Average age: 25.2, range 5-68) groups. Most transcripts (41.4%) were best described by the model: Dx + Sex + Dx *Sex, followed by the Dx + Sex + Age + Dx*Age +Dx*Sex model (24.9% of the transcripts). 330 genes displayed DAS in ASD vs. TD considering both sexes, there were 795 in ASD-Male vs. TD-Male, and 41 in ASD-Female vs. TD-Female. Genes with DAS were over-represented in immune and neurotransmitter pathways. Some of these have previously been implicated in ASD, such as mTOR Signaling, CREB Signaling in neurons, and Glutamate and GABA Receptor Signaling pathways (Males analysis). There was significant overlap with ASD-implicated genes from the SFARI database with our all ASD vs. TD (33 genes, hypergeometric probability = 1.3E-06) and ASD-Male vs TD-Male (81 genes, p=7.9E-15) differentially alternatively spliced gene lists. Among the genes with DAS in ASD-Male, the RBFOX2-12 transcript was down-regulated. RBFOX2 (RNA Binding Protein, FOX1 Homologue 2) regulates alternative exon splicing in the nervous system and is homologous to the neural-specific splicing regulator FOX1 (A2BP1) which has been reported to be down-regulated in ASD brain (Voineagu et al, 2011). We compared our genes with DAS to the 196 genes with FOX1-dependent DAS identified by Voineagu et al. (2011). There was a significant overlap with our all ASD vs. TD (9 genes, p=0.004) and ASD-Male vs. TD-Male (32 genes, p=4.1E-12) gene lists.
Conclusions: There is differential transcript isoform expression in STG in ASD which is modulated by age and sex, and which likely contributes to ASD pathophysiology. Future studies will need to confirm these findings.

132 **108.132** Dysregulation of Cortical Neuron DNA Methylation in Autism: Implication of Gabaergic and Immune System-Related Genes

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Background: Epigenetics has been implicated as a primary molecular mechanism that may mediate the interaction between environmental factors and the development of ASD. Previous epigenetic studies in post-mortem brains have been severely limited by the cellular heterogeneity of the brain tissue, which impairs our ability to determine specific and robust epigenetic changes in the brain.
Objectives: Our main objective is to determine changes in the epigenetic signature in cortical neurons of individuals diagnosed with autism, compared to matched controls. Further objectives include to understand the biological function of the dysregulated epigenetic signature and to determine if genomic regions that display epigenetic plasticity during brain development are particularly sensitive to dysregulation in ASD.
Methods: To investigate methylation changes specifically in neurons from the frontal cortex of autistic and control subjects, we employed Fluorescent Activated Cell Sorting (FACS) of neuronal nuclei from post-mortem brains, followed by hybridization of DNA on 450K BeadArray. Bumphunting analysis (using CHAMP tool) was performed to find differentially methylated regions and WGCNA analysis was performed to determine co-methylated modules of CpGs that correlate with autism status, followed by gene ontology and protein-protein interaction analysis. Targeted Bisulfite Sequencing was used to validate differentially methylated regions. Differentially methylated regions and correlated modules were compared to published datasets of CpGs that are differentially methylated during neurodevelopment.
Results: We identified 58 Differentially Methylated Regions (DMRs) at *FDR* <0.05 that included genomic loci associated to GABAergic system genes, in particular *ABAT* and *GABBR1*, and brain-specific MicroRNAs, *Mir124-1* and *Mir124-2*. We verified a subset of these DMRs by targeted bisulfite sequencing. At system level, Weighted Co-Methylation Network Analysis (WGCNA) detected three major modules significantly correlated to ASD. Two modules (p=2e-04; p=0.008) were inversely correlated with ASD and were enriched for regions underlying neuronal genes (synaptic genes, as well as GABAergic genes), whereas one module (p=0.001) showed direct correlation and was enriched for regions underlying immune genes. Protein-protein interaction networks determined a subset of neurotransmitter-related genes that were enriched in several of these modules. In a comparison between our data and published data on neurodevelopment-associated DMRS, A remarkable overlap of the 58 autism-related DMRs with age-specific (from embryonic to late-fetal neurodevelopment) and cell-type specific (neuron; glia) DMRs was observed. Finally, we established the specificity of these three modules to ASD by assessing their enrichment for GWAS databases related to other psychiatric and non-psychiatric disorders.
Conclusions: We have identified multiple genomic regions that display dysregulated DNA methylation in cortical neurons from individuals with ASD. These regions are highly relevant to biological mechanisms that have been implicated in autism. Our study suggests that robust analysis of specific cells in the brain is an important goal in understanding the epigenetics and molecular biology of the development of ASD. Our study identifies alterations of DNA methylation in cortical neurons as a plausible environment-mediated component to ASD aetiology.

133 **108.133** Epigenomic Mechanisms Underlying Pathology in Chd8 Haploinsufficiency

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Background: Exome sequencing studies of patients with autism spectrum disorder (ASD) have identified *de novo* mutations in *CHD8*. *CHD8* haploinsufficiency is proposed to drive neurodevelopmental pathology via genome-wide changes in chromatin state and gene expression. However, the biological processes and underlying regulatory mechanisms negatively impacted during neurodevelopment by reduced CHD8 dosage remain unknown. Mapping these changes may give insight into ASD pathophysiology.
Objectives: We used a mouse model harboring a germline loss-of-function mutation in *Chd8* to study the role of Chd8 and chromatin remodeling in neurodevelopment through genomic characterization.
Methods: Bulk forebrain was dissected from $Chd8^{+/-}$ and wildtype littermates at post-conception days 12.5, 14.5, 17.5, 21, and ~77. We used RNA-seq and ChIP-seq to map the transcriptional and genomic impact of *Chd8* haploinsufficiency during development.
Results: Transcriptional profiling of $Chd8^{+/-}$ mice revealed widespread transcriptional changes throughout development involving genes important for RNA processing and chromatin remodeling as well as genes previously implicated in studies of genetic contributions to ASD. Epigenomic profiling of Chd8 binding provides evidence that it directly regulates expression of differentially expressed genes, including RNA processing, chromatin remodeling, and ASD-relevant genes. Further analysis shows strong Chd8 binding to genes with decreasing expression over neurodevelopment, suggesting typical Chd8 expression is required for transcriptional activation during brain development.
Conclusions: These results reveal pathophysiology associated with single copy loss-of-function mutations of chromatin remodeling genes, providing insight into one of the most intriguing findings from large-scale ASD genetic studies.

134 **108.134** Examining Minor Physical Anomalies in Autism Spectrum Disorder (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD): A Twin Study

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Background: Â Minor physical anomalies (MPAs) represent subtle anatomical deviations in one's appearance such as low-set ears, widely spaced eyes, and a short neck. MPAs may suggest some type of abnormal development that occurred in the early embryogenic or fetal periods. MPAs have been shown to be more common in individuals with ASD and ADHD. Further studies are needed, especially with a well-controlled genetic background, to examine this relationship in children and young adults with ASD and ADHD.
Objectives: To describe the findings from clinical morphology exams on monozygotic (MZ) and dizygotic (DZ) twins to identify MPAs in children and young adults with ASD and ADHD, with a special focus on differences in the number of MPAs based on the presence of a diagnosis, the most common MPAs in participants with ASD or ADHD, differences in MPAs in highly discordant pairs, and the relationship between MPAs in twin pairs based on zygosity.
Methods: Clinical morphology exams to identify the presence of MPAs were conducted on 120 individuals representing 51 MZ pairs, 7 DZ pairs, 1 trio of triplets (MZ sisters and DZ brother), and 1 DZ twin. Two clinical geneticists utilized a checklist covering all major body systems to uniformly identify MPAs. All participants also received detailed clinical assessments, including determination of ASD and ADHD through gold standard assessments (e.g., ADOS, ADI-R, SRS, Connors-3, K-SADS, etc.). Roughly 24% of participants had a diagnosis of ASD, 28.3% had a diagnosis of ADHD, and 42.5% were typically developing (42.5%). Descriptive and correlational statistics were performed to summarize the findings from the clinical exams.
Results: The clinical exams revealed the presence of more physical anomalies in participants with ASD (median=9) and ADHD (median=7) compared to those with typical development (median=5). The most common physical anomalies in participants with ASD (n=29) and ADHD (n=34) included hypermobility (37.9% with ASD and 32.4% with ADHD) and being overweight (37.9% with ASD and 26.5% with ADHD). Comparing highly discordant pairs for ASD (i.e., MZ pairs where only one twin has ASD; n=7 pairs), scoliosis was present in the twin with ASD in two pairs. Using a correlation plot, twins who were MZ, regardless of the presence of a diagnosis, demonstrated a positive linear relationship (r_s=.883, p<.001) between the number of MPAs within each twin pair, compared to DZ twins who demonstrated a non-linear relationship (r_s=.209, p=.653), thereby, suggesting a strong genetic basis to MPAs.
Conclusions: Minor physical anomalies were present in children and young adults with ASD and ADHD in greater amounts compared to those without either disorder and appear to have a strong genetic basis when looking at the relationship in the number of MPAs within MZ and DZ twin pairs. Examination of minor physical anomalies in children and young adults with ASD and ADHD may serve as a biomarker to identify individuals with a genetic cause to ASD or ADHD and thereby, help identify potential subtypes of each disorder and/or individuals who would benefit from further testing (i.e., genetic testing).

135 **108.135** Exploring Heterogeneity in the ASD Blood Transcriptome: Machine-Learning Classification Accuracy Is Improved By Modeling Subgroups.

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Background: Blood-based microarray studies comparing individuals affected by autism spectrum disorder (ASD) and typically developing individuals have helped characterize differences in circulating immune cell functions and offer potential biomarker signal. Genetic heterogeneity is widely recognized within the ASD phenotype and at the level of etiology, yet relatively few studies have explicitly examined heterogeneity in the transcriptome.
Objectives: We sought to examine heterogeneity in the ASD blood transcriptome.
Methods: Recently, we combined the subject-level data from previously published blood microarray studies in order to perform combined-samples mega-analysis. The present study utilized a subset of these data (male samples self-identified as European ancestry; n_{asd} =417, $n_{control}$= 243). We identified genes and functional gene-sets that were differentially expressed within this sample. We then clustered ASD-affected samples into putative subgroups based on genes and gene-sets, as well as expression principal components.
Results: Machine-learning classification accuracy in withheld samples was significantly improved for subgroup-informed classification problems (*e.g.,* ASD subgroup *k vs.* all comparison; overall accuracies ranging from 67 to 76%), as compared with the baseline classification problem (*i.e.,* all ASD samples *vs.*all comparison; overall accuracies ranging from 61 to 63%); this effect was most pronounced for gene-set- and PCA-based subgroups. All subgroup solutions showed pronounced differences in leukocyte-specific marker genes, indicating that heterogeneity in cellular composition contributes critically to transcriptomic heterogeneity. Additionally, many of the subgroup solutions showed significant differences in domains of the Mullen Early Learning Scale and comorbid developmental conditions.
Conclusions: These findings begin to shed light on heterogeneity within the ASD blood transcriptome.

136 **108.136** Gene Expression Correlates of Language Regression in Autism Spectrum Disorder

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Background: Language regression occurs in approximately one-third of children with autism spectrum disorder (ASD) in the first three years of life (Goin-Kochel et al., 2014). Individuals with ASD who experience regression were found to have poorer outcomes of adaptive, cognitive, and social-communicative functioning, compared to those with ASD with no regression (Parr et al., 2011). However, the mechanisms underlying this behavioral phenotype remain unknown (Jones & Campbell, 2010). Recently, gene coexpression network analysis has identified specific spatial and temporal expression patterns in genes associated with ASD (Willsey et al., 2013). Further analysis of gene expression trajectories in the canonical language region of the superior temporal cortex during prenatal and early postnatal development may help to reveal molecular mechanisms of language regression in children with ASD.
Objectives: To investigate superior temporal cortical gene expression correlates of language development and regression in individuals with ASD with likely gene disrupting mutations.
Methods: Participants were 353 children from the Simons Simplex Collection with likely gene disrupting mutations (as defined by Iossifov et al., 2014) who meet strict criteria for ASD. Superior temporal cortical gene expression data from eight weeks post-conception to three years post-birth was extracted from the BrainSpan transcriptome RNA-seq data (http://www.brainspan.org). Coexpression modules were constructed using signed weighted gene coexpression network analysis (WGCNA; Parikshak et al., 2013). 56 children with parentally reported history of developmental regression in language skills were compared to 294 children without language regression. First, a nonparametric analysis was performed to examine the relationship between the presence of language regression and gene expression trajectories as identified in coexpression modules. Next, coexpression groups were compared using one-way analysis of variance on parentally reported age of first spoken single words and age of first spoken phrases.
Results: Five coexpression modules were identified with two modules representing clear increases in expression levels and one module representing decreasing levels of expression over prenatal and early postnatal development. No relationship was found between coexpression module and rate of language regression ($\chi 2 = 4.44$, $p = 0.35$). In addition, no significant differences in age of first spoken words ($F(4,289) = .542$, $p = .71$) or first spoken phrases ($F(4,270) = 1.001$, $p = .41$) were found among coexpression module groups.
Conclusions: Gene coexpression network analysis was used to identify differential gene expression patterns among children with ASD with and without language regression. Our evidence suggests that differential gene expression trajectories in the superior temporal cortex are unlikely to contribute independently to the language regression seen in some children with ASD. Future studies should investigate gene coexpression networks focused on other brain regions implicated in language development. Better understanding of the developmental timing of gene expression in genes disrupted in individuals with ASD may aid in explaining the phenotypic variability in language outcomes among children with ASD.

137 **108.137** Genetic Influence on Treatment Response in Children with ASD

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Background: Antipsychotic, antidepressant or stimulant medications are used for the treatment of ASD comorbidity, including symptoms such as aggressiveness, euphoria, anxiety, and depression. However, 30-40% of treated children do not respond to pharmacological treatment and an important proportion present clear deterioration. In addition, 60-70% of them present severe and long-lasting side effects. The reasons behind treatment failure are unclear, and few studies have investigated response determinants in ASD children.
Objectives: We hypothesised that genetic factors in genes coding for metabolic enzymes and in genes coding for drug targets may contribute to treatment failure. The identification of the genetic factors that influence response and side effects may help to improve treatment in ASD children
Methods: To test this hypothesis we investigated 32 single nucleotide polymorphisms (SNPs) in 16 genes relevant to pharmacological treatment (CYP1A2, CYP2C9, CYP2C19, CYP2D6, CYP3A5, MDR1, D2, D3, 5-HT1A, 5-HT2A, 5-HT2C, BDNF, COMT, MC4R, LEP and CNR1) in 72 ASD children (88% males, mean age: 8 ± 2.6) treated with a antipsychotics and stimulant medications (risperidone, aripripazole and methylphenidate).
Results: a genetic variant (rs4244285) in the enzyme CYP2C19, was found associated with treatment-induced weight gain ($p<0.04$). A trend towards association between a polymorphism in the CNR1 gene (rs489693) and weight gain was also observed ($p=0.06$). No significant associations were detected with level of treatment efficacy.
Conclusions: if confirmed, this pharmacogenetic information may help to identify children susceptible of gaining weight during pharmacological treatment, who may benefit from alternative medications and/or palliative interventions.

138 **108.138** Genetic Investigation of Restricted and Repetitive Behaviors in Autism

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Background: Restricted and repetitive behaviors (RRBs) are a defining feature of Autism Spectrum Disorder (ASD). Two RRB subdomains, repetitive sensory motor behaviors (RSMB) and insistence on sameness (IS), have yielded suggestive association in prior genetic studies of ASD. We hypothesize that genetic variants modify the expression of RRBs in individuals with ASD, and that this genetic variation will be associated with RSMB and IS scores.
Objectives: The primary objective of this study is to search for genetic association to RSMB and IS scores using targeted sequence data.
Methods: Using the ADI-R, a semi-structured interview for ASD, RSMB and IS scores were calculated in 1118 ASD participants from the Hussman Institute for Human Genomics and the Simons Simplex Collection. All individuals had DNA sequence data available from a 17Mb custom capture covering 681 genes within regions identified by GWAS of ASD. Gene-based and single-variant tests for association with IS and RSMB as quantitative traits were conducted using SKAT-O. Combinations of synonymous, non-synonymous, missense, stop, loss-of-function and splice variants were investigated in different hypothesis tests. A Bonferroni correction for the number of genes tested was used as a significance threshold for each hypothesis with an experiment-wise significance level of 0.05.
Results: Gene-based tests revealed different genes in association for the respective traits although none passed Bonferroni correction. For the IS trait, two zinc finger genes were most significant when all exonic variants were included (ZNF397 p=2.24E-03, ZSCAN30 p=2.63E-03) and when only missense variants were examined (ZNF397 p=2.73E-03, ZSCAN30 p=3.16E-03). For the RSMB trait, we observed a convergence on the gene PTPRT for analyses of both damaging (p=1.49E-04) and missense (p=1.63E-04) variants. PTPRT (protein tyrosine phosphatase, receptor type, T) is a gene which is highly expressed in the developing and adult CNS and is involved in both CNS signal transduction and cellular adhesion.
Conclusions: These results are in line with prior clinical studies showing IS and RSMB as distinct types of RRBs, potentially supporting this distinction at a biological level. This work is preliminary but suggests that there is value in dissecting the ASD phenotype into measurable traits that can be tested for association to genetic variants.

139 **108.139** Genetic Stratification Based on Biological Networks in Autism Spectrum Disorders

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Background:
The genetic architecture of Autism Spectrum Disorders (ASD) has proved to be complex and heterogeneous. For better prognosis and treatment, genetic stratification is suggested which aims to classify patients into more homogeneous subgroups. Cancer research has recently proposed Network Based Stratification (NBS) to stratify tumors into meaningful subtypes of similar molecular profiles by integrating protein interactions (Hofree *et al* 2013).
Objectives:
We aim to classify heterogeneous patients with genomic data into more homogeneous subgroups to associate them with clinical outcomes. NBS combines genomic information of each patient and Protein-Protein Interaction (PPI) networks. We developed an open source NBS toolkit in Python and propose to probe the impact of mathematical parameters on ASD stratification at both biological and phenotypical levels.
Methods:
At first, we validate the NBS method with the original cancer data contributed by The Cancer Genome Atlas: 235 patients with uterine cancer. Once validated, we applied the NBS to an ASD cohort that involves 115 autistic patients, 354Â related and 230 controls. We have the whole exome sequence of all participants, and clinical data.
After mutated gene's score were diffused over neighbors, just like a thermal conduction, we reduced matrix dimension using Non-negative Matrix Factorization (NMF). This procedure aims to decompose a matrix into two lower rank matrices whose product can approximate the original matrix (Lee *et al* 1999). In addition, for the second application of graph topology, we introduce a Graph regularized NMF (GNMF) algorithm which respects the structure of the underlying gene interaction network and avoids the limitation of Euclidean space by incorporating a geometrically based regularization (Cai *et al* 2010). Finally, a consensus is calculated across 1,000 resampling iterations with hierarchical clustering. We then compare and analyze each subgroup characteristics at genomic, phenotypic and network topological level.
Results:
Our systematic and exhaustive investigation of all the parameters delivers the first guidelines to run NBS in ASD cohorts. The pilot study on cancer data already indicated that: 1) the diffusion step was essential but not the GNMF; 2) median quantile normalization could lead to even better results with just diffusion and NMF. Our ASD study focused on rare deleterious germline mutations, whether inherited or *de novo*. Our preliminary results on ASD data reveal that: 1) in contrast to cancer, homogeneity of mutation profile across patients is preventing a drive of the clustering by mutation numbers; 2) modifying the diffusion factor allows to change the size of the mutated sub-network areas and potentially open up the ability to investigate local and global effects; and 3) NBS with a systematic PPI network (Rolland *et al* 2014) outperforms previous attempt with literature based networks. Moreover, several subnetworks stratifying patients with ASD were identified and will be presented.
Conclusions:
Moving beyond the traditional dichotomy between monogenic and polygenic approaches, the NBS provides a versatile method to tackle heterogeneity of ASD and combined with proper clinical data has the possibility to uncover new relevant genotype-phenotype relationships, such as comorbidities and drugs response, for better prognosis and care of patients with ASD.

140 **108.140** Genetic Test Results in Children Under 3 Years of Age Who Are at-Risk for Neurodevelopmental Disorders: An Update

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Background: A significant incidence of genetic aberrations has been documented in individuals with autism spectrum disorder and other neurodevelopmental disabilities (NDD) [Roberts et al., 2014]. The earlier these genetic alterations are identified, the sooner the individual can receive targeted interventions to reduce the impact of these disorders and improve outcomes. Several neurodevelopmental assessments have been designed to identify at-risk infants, including the Comprehensive Autism Spectrum Screening for Infants (CASS-i), which is meant to identify infants younger than 12 months who are at-risk for ASD/NDD [Samango-Sprouse et al., 2015].
Objectives: To report the genetic aberrations in infants who fail the CASS-i . Specifically, we provide an update of copy number variants (CNVs) identified by chromosomal microarray analysis (CMA; which was reported at the IMFAR in 2016) and report on newly identified findings from whole exome sequencing (WES) in the same patient cohort.
Methods: Fourteen infants under the age of 3 years who failed the CASS-i were offered clinical CMA testing and research-based WES. CMA was done on a custom Affymetrix platform designed to optimize detection for genetic variants that underlie ASD as other NDD (FirstStep^{Dx} PLUS ®; Salt Lake City, UT). WES was performed using the AmpliSeq Exome target capture kit and Ion Torrent sequencers (ThermoFisher Scientific, Inc.) to an average read depth of 100X. Analysis of the sequence data was performed using the WuXi/NextCode Clinical Sequence Analysis pipeline (https://www.wuxinextcode.com/). Additional analysis of copy number variants and sequence variants using the method of Uddin et al. (2014) was used to identify novel genes possibly relevant to neurodevelopmental disorders.
Results: Fourteen patients underwent clinical CMA testing and 4/14 had a reportable CMA finding (~28%) Thirteen patients underwent research WES; following variant filtration based on allele frequency and phenotypic relevance, roughly 40-50 variants requiring further evaluation were identified in each individual. A summary of these findings from both methodologies will be presented, along with specific examples to demonstrate the improved medical management that comes with a specific genetic diagnosis.
Conclusions: Genetic testing is an important component in the clinical work-up of individuals with ASD/NDD. Of patients who fail early developmental screens, over 10% are expected to have a reportable finding on CMA and over 80% of are expected to have a reportable finding on WES. Clinicians should implement screening and genetic testing protocols to improve early detection and implement personalized medical management for patients with ASD/NDD. This often affords families both individualized and targeted treatment.

141 **108.141** Genetic and Neurobehavioral Profile of the SHANK3 Gene Deficiency Children in China

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Background: SHANK3 is a scaffolding protein of excitatory glutamatergic synapses. Genetic studies suggested that molecular variations in the *SHANK3* gene had a strong causal relationship with ASD and/or 22q13.3 deletion syndrome, and different defects in this gene potentially resulting in clinical heterogeneity.
Objectives: To determine the data of Chinese ASD patients with *SHANK3* deletion.
Methods: MLPA and Sanger sequencing were carried out to confirm the *SHANK3* deficiency of nine Chinese children. Moreover, systematic and comprehensive evaluations were performed to Chinese-specific features. ADOS scale was applied to examine the severity of autism and Griffith scale was used to assess the development level.
Results: Six participants lacked the whole gene of *SHANK3* with 22q13.3 deletions ranging in size from 55 kb to 4.8 Mb and three participants with de novo *SHANK3* mutation were included. The samples were characterized by high rates (100%) of ASD, developmental delay, hypotonia, several dysmorphologies and perception abreaction. New and rare features were also viewed in this study: ectropion of nostril sparse hair, ankle deformity, whole-body hairy, hanked-3-lap arms, snaggletoothed or extra teeth and unusual-dehydrated skin, and extreme hyperactivity/self-sitimulation. There was no significant statistical difference between SHANK3 defect group and ASD group. However, SHANK3 defect children displayed severer developmental delay in language, social, gross motor, fine motor, adaptability and other items comparing with ASD group. In addition, separating numerous phenotypes into inherent phenotypes and ameliorable phenotypes may contribute to better analyze genotype-phenotype correlations. Ameliorable phenotypes may be independent of gene deficiency and improvable. Epilepsy and degeneration could aggravate symptoms and deteriorate prognosis of diseases.
Conclusions: This study supports findings from previous research on the severity of intellectual, hypotonia, and speech impairments seen in *SHANK3* deficiency, and highlights the prominence of SHANK3 in the syndrome. Early diagnosis and early intervention, as well as consciousness and training of caregivers were very critical in the improvement of these children.

142 **108.142** Genome-Wide Association Study Suggests Genetic Homogeneity within Complex Autism Subgroup

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Background:
Autism is phenotypically and genetically heterogeneous, prompting our focus on identifying, defining, and studying genotypic differences between clinical autism subgroups. Few studies have examined genetic differences between subgroups on a genome-wide scale. Furthermore, though the development of autism can seldom be explained by a single factor, little is known about how genetic factors interrelate to cause autism.
Objectives:
Since a large proportion of autism heritability is thought to be caused by common genetic variants (Gaugler et al., 2014), we expect that many cases of autism arise from specific combinations of common variants. We aim to discover associations between common variants and clinical autism subgroups. In particular, we focus on testing combinations of multiple variants to identify potential interactions that contribute to the development of autism. Examining all combinations of millions of variants is impossible, so we generate candidate combinations using a data-driven method that measures the prevalence of minor alleles in autism subgroups.
Methods:
Using the SFARI SSC dataset containing ~3 million variants, ASD probands were sorted as “essential” (n=436) or “complex” (n=76). Using a well-studied autism subtype classification, individuals are designated “complex” based on physical evidence of an insult to early morphogenesis (Miles, et al., 2008, Tammimies et al., 2015). Frequent pattern mining, a data mining algorithm, was used to calculate prevalence of variant combinations within each subgroup. We identified the variant combinations that had the highest difference in subgroup prevalence; these were tested for association with the subgroups.
Results:
After excluding combinations exhibiting linkage disequilibrium due to physical proximity, frequent pattern mining identified 14 individual variants and 27 combinations of variants that were at least twice as prevalent in the complex subgroup, versus 13 individual variants in the essential subgroup. 8 of the individual variants and 23 variant pairs were significantly associated with the complex subgroup (family-based association test; $p<.01$). In contrast, the essential subgroup had no associated variants, individually or in combination. We speculate that the complex subgroup is a more genotypically homogeneous group, leading to these stronger associations. We found multiple variants within the LPPR3 gene to be associated with the complex subgroup; to our knowledge this gene was not previously associated with autism. 16 of the 23 significant variant pairs involved the ISM1 gene, linking it to genes and non-genic regions on various chromosomes. Stewart, et al. (2013) previously associated ISM1 with obsessive-compulsive disorder and noted several ISM1 gene-gene correlations related to that disorder as well, but the gene has not been specifically associated with autism.
Conclusions:
Our preliminary study identified several combinations of common variants associated with the complex dysmorphology autism subgroup. This suggests that the complex subtype is more genetically homogeneous than the essential subtype, contrary to prior belief. Further analysis is required to study the relationships between the implicated genes and how they might contribute to autism development. We expect that applying this method to more autism subtypes will lead to the discovery of more genetic distinctions between groups.

143 **108.143** Genomewide Association and Meta-Analysis of Autism Spectrum Disorder in the Multi-Ethnic Charge Cohort

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Background:
The Childhood Autism Risks from Genetics and the Environment (CHARGE) study is population-based cohort of children with autism or developmental delay and typically developing children, recruited from a statewide database of persons receiving services from regional centers in northern California, from clinical and self-referrals and referrals from other studies at the MIND Institute. Genomewide association studies (GWAS) are a standard genetic epidemiological tool for the assessment of genetic contributions to risk of disease and have produced evidence for genetic variants in a range of psychiatric and neurodevelopmental disorders. A number of GWAS have been performed in ASD and identified many associations, however there have been few successful replications, perhaps in part because of high polygenicity and variable effect sizes.
Objectives:
We performed GWAS in the CHARGE cohort using the Affymetrix European-specific array, which was developed in conjunction with UCSF and Kaiser Permanente.
Methods:
Genotypes were called in Genotyping Console and standard quality control measures were applied. Principal components analysis (PCA) was used to compare self-reported ancestry with HapMap anchors and extreme outliers removed. Each ethnic ancestry population was then subject to separate PCA to generate eigenvalues and used to control population stratification in the association analysis. Data were imputed to the Haplotype Reference Consortium reference panel. All quality control and analyses for each population were performed in R and PLINK, and meta-analysis across populations performed using METAL.
Results:
Subjects were separated into six ethnically distinct; non-Hispanic whites, Hispanic whites, Hispanic other, African American, Asian and Multi-ethnic. The African American and Asian groups were not analyzed due to very low subject numbers.
Five genomewide significant signals were detected on chromosome 2, with a minimum p value of $1.6x10^{-8}$. All signals were located in introns of the ceramide kinase-like gene CERKL. This gene contains multiple transcripts and non-coding RNA's and encodes a protein with ceramide kinase-like domains but does not phosphorylate ceramide and is currently of unknown function. It is widely expressed, but different transcripts are expressed in different tissues and at different time points of development.
Conclusions:
Meta-analysis of multi-ethnic cohorts is a useful tool for dissection of complex traits such as autism and here identifies genome-wide significant signals on chromosome 2 in the CERKL gene. This gene is of unknown function and so its relevance to ASD cannot be assessed. Other genes in the region include integrin alpha 4 (ITGA4), a cell surface adhesion and signaling protein associated with the autoimmune disorders inflammatory bowel disease and multiple sclerosis and the neuronal differentiation gene NEUROD1, known to be associated with Type 1 diabetes. Additional analyses and deeper investigation into these results will be presented.

144 **108.144** Hierarchical Cortical Transcriptome Disorganization in Autism

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Background: The pathophysiology behind atypical brain development in autism spectrum disorder (ASD) is highly complex. Several elegant genetic studies have unveiled a diverse array of biological mechanisms associated with ASD and functional genomics work has begun to identify specific dysregulated transcriptomic pathways. In particular, examination of the ASD cortical transcriptome at the systems-level has highlighted dysregulation in two important gene modules (i.e. collections of genes whose expression levels are highly correlated). The first module is downregulated and enriched for synaptic processes and neuronal markers, while the second module is upregulated and enriched for immune/inflammation processes and astrocyte and M2 microglia activation state markers.
Objectives: A key question that remains unclear is whether these pathways are independently dysregulated or some convergence/interaction exists between such systems.
Methods: To address this question we analyzed the cortical transcriptome of two independent ASD datasets (Gupta et al., 2014; Voineagu et al., 2011) using different statistical and network-based gene expression and protein-protein interaction approaches. We tested the hypothesis that diverse molecular mechanisms are hierarchically disrupted in the cortical transcriptome of ASD and point towards interacting systems-level pathology rather than multiple independent types of pathology in synaptic and immune processes. Specifically, we hypothesize that dysregulated gene co-expression modules may work in synergy to form emergent pathology not visible by looking at single modules in isolation.
Results: We identify replicable evidence for 10 gene co-expression modules that are differentially expressed (DE) in ASD cortical tissue. Rather than underlying distinct non-interacting pathology, these modules DE modules are highly correlated and such correlations increased in ASD. Moreover, this synergy and interaction was present at the protein level. This systems-level pathology is characterized by downregulated synaptic and neural developmental processes and upregulated catabolism, viral processes, translation, protein targeting and localization, interferon signaling, glia-relevant, and apoptosis processes. Our hierarchical examination of the ASD cortical transcriptome also shows important disorganization at the level of meta-modules (clusters of highly correlated modules). We identify subtle and specific changes in summary measures of networks organization or global patterns of network reorganization providing important insights on how the ASD cortical transcriptome is affected at the systems-level.
Conclusions: This work highlights a hierarchical view of cortical transcriptome dysregulation in ASD. In doing so, we provide novel insight into new dysregulated processes coordinated with other previously described dysregulated signals. Our approach allows for a better bird's eye view of how multiple pathophysiological processes may operate in ASD and may hint at new systems level phenomena as a potentially more accurate description of the pathophysiology affecting the brain in ASD. This perspective may have important translational and clinical implications as well as potential to help enable cross-level work connecting systems biology with systems neuroscience.

145 **108.145** High Diagnostic YIELD and Low Therapeutic IMPACT of Array-CGH in the Clinical Management of Autistic Patients.

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Background: Â Array-CGH has become a first-tier clinical diagnostic test in the medical management of children with autism spectrum disorder (ASD). However, the full medical implications of this approach beyond diagnosis have not been explored.
Objectives: Â (1) To propose specific criteria for the definition of a "positive" or "negative" array-CGH outcome; (2) Based on these criteria, to define the diagnostic yield of array-CGH in a sample of Italian ASD patients; (3) To define the follow-up diagnostic and therapeutic yield, whereby further positive diagnostic assessments and therapeutic interventions were driven by array-CGH results.
Methods: Â Array-CGH was performed using the Human Genome CGH SurePrint G3 Microarray 4x180K Kit (Agilent Technologies). CNVs were classified into "rare" or "common" using the last release of Database of Genomic Variants (DGV) setting the threshold for "rare" at ≤4 gains or losses in DGV. All genes spanned in rare CNVs were sought in the autism candidate gene lists present on the Simons Foundation web site (https://id.sfari.org/) and the AutismKB database (http://autismkb.cbi.pku.edu.cn/).
Results: Â Array-CGH outcomes were blindly classified by four authors (AMP, CL, SG, CP) into five categories, based on a stringent set of criteria: 1-"Positive - certainly causal", 2-"Positive - probably causal or with relevant functional consequences", 3-"Uncertain causality", 4-"Negative - common variant with modulatory effects", 5-"Negative - No functional role". Array-CGH results were obtained for 182 families (159 simplex and 23 multiplex), including 581 individuals. A positive yield was obtained from 21 (10.0%) and 39 (18.8%) of 209 ASD patients for outcome cat. n. 1 and 2, respectively. Based on array-CGH results, further medical testing was undertaken in 43/209 (20.1%) ASD patients and 10/372 (2.7%) first-degree relatives. These exams include: brain MRI (with/without 31P spectroscopy); urinary and blood levels of Mg++ or proline; EKG; cardiac or abdominal sonogram; consultations with cardiology, immunology, pneumology, ophtalmology; auditory evoked potentials; capillary fragility testing; blood liver parameters and lipids; blood amino acids; glucose tolerance test; IQ and memory (in family members). These tests turned out positive in 8/209 (3.8%) ASD patients and in 3/372 (0.8%) first-degree relatives. Pharmacological or supplement therapies driven by array-CGH results were prescribed in 2/209 (1.0%) of ASD patients and clinical improvement was recorded in 1/209 (0.5%) case.
Conclusions: The high diagnostic yield obtained by array-CGH in our sample confirms the usefulness of this test in the autism clinic. Array-CGH are also able to successfully guide further medical testing in a small percentage of ASD cases, who would not have been further assessed otherwise. To this date, the therapeutic impact of positive array-CGH results remains elusive, due to the lack of ASD-specific drugs. Nonetheless, array-CGH appears a strong candidate to contribute, in conjunction with whole-exome sequencing and with other exams and specific biomarkers, to the molecular characterization of ASD patients in view of future targeted personalized pharmacological therapies.

146 **108.146** High Frequency of CNVs Targeting Genes That Regulate Exposure to Toxicants in Autism Spectrum Disorder (ASD) – a Role for Gene-Environment Interactions

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Background:
ASD is a neurodevelopmental disorder characterized by complex clinical presentation and multifactorial etiology. While genetic variants, including Copy Number Variants (CNV), are responsible for a substantial fraction of ASD etiology, pre-, peri- and post-natal exposure to environmental factors has also been implicated. Permeability barriers, such as placenta and blood-brain barrier (BBB), are crucial in limiting the exposure to toxicants, particularly during neurodevelopment, while detoxification is fundamental for removal of toxic substances from the organism. Genes encoding molecules involved in these processes are therefore obvious candidates to mediate an increased genetic susceptibility to environmental toxicants in ASD.
Objectives:
In this study we seek to identify genetic variants that may interact with environmental factors in ASD.
Methods:
Genes relevant for detoxification and permeability of the BBB or the placenta to environmental toxicants were selected through literature review and databases (Human Protein Atlas and The Toxin and Toxin-Target Database). We examined the frequency of CNVs deleting or duplicating selected detoxification and permeability genes in ASD subjects genotyped by the Autism Genome Project (N=2157), and compared with CNV frequencies in a control dataset (N=10355), available from the Database of Genomic Variants (DGV). ASD and control subjects were genotyped using Illumina platforms. Statistical analysis was performed using SPSS, and Bonferroni correction for multiple testing was applied. Pathway enrichment analysis was performed using STRING.
Results:
We identified 491 genes involved in detoxification or permeability for toxic substances. In 1107 ASD individuals (51%) we found that 240 (49%) of the selected genes were targeted by CNVs. Comparing with a control subject dataset, we identified 51 genes (21%) exclusively found in CNVs from 88 ASD patients (4%). *CYP2D6* was the most frequently targeted gene (in 16 ASD subjects, 0.74%), followed by *GAL3ST2*, *ARSF* and *TRIM64B*, targeted by CNVs found in 6, 5 and 4 ASD patients, respectively. From the 189 genes identified in CNVs from both patient and control subjects, 40 genes were significantly more frequent in CNVs from individuals with ASD compared with controls, after correction for multiple testing ($P<2.6x10^{-4}$). Many of the ASD-exclusive or associated genes clustered in xenobiotics-related processes (*eg. CYP450* and *UGT* genes), in transport mechanisms (*ABCB1, SLC2A3* and *SLC2A14*) or in tight-junctions function (*CLDN5*, *OCLN*, *PARD6G* and *PRKCZ*); others, like *COMT* and *SHANK2*, were previously implicated in ASD etiology.
Conclusions:
This work reinforces the hypothesis that interactions between environmental exposure and genetic variation may contribute to ASD. Some of the genes more frequently deleted/duplicated in ASD subjects are part of ubiquitous metabolic or transport pathways, suggesting overarching sensitivities to a wide variety of toxicants. Others, with specific targets, may identify the most damaging toxicants for genetically susceptible individuals, suggesting preventive and therapeutic measures. Clinical correlations are currently being explored.

147 **108.147** Mapping Developmental Trajectories in 22q11.2 Deletion Syndrome

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Background: 22q11.2 deletion syndrome is a common, recurrent CNV that is associated with autism spectrum disorder, with 20% of children with this genetic syndrome also having an autism diagnosis. However, the variability in developmental outcomes of children with 22q11.2 deletion syndrome is very broad, with varying amounts of ASD symptomology and varying degrees of intellectual disability. This variability makes it difficult to accurately predict outcomes (e.g., ASD v. non-ASD; level of cognitive impairment) that can be helpful for future planning. We have a pressing need for a comprehensive approach accounting for behavioral presentation while recognizing key factors that affect long-term phenotypic variability (e.g., genetic etiology, familial background and medical comorbidities).
Objectives: Our study aims to better understand longitudinal outcomes of children with 22q11.2 deletion syndrome (22qDS) by combining developmental assessments, medical comorbidities, genetic etiology, and family background in an ordinal logistic regression model.
Methods: We have identified 15 probands with 22qDS who have been consented for research and have been entered into our research database. All of these probands have at least one developmental assessment; in addition, 7 have at least two assessments ranging through as many as five developmental assessments already completed (at least annually). We used mathematical approaches, including generalized linear mixed models (GLMMs) and generalized estimating equations (GEEs), to identify clinical factors that are the most predictive of developmental outcomes. In particular, clinical factors we investigated include genetic diagnosis, and medical comorbidities. Longitudinal developmental profiles were developed for children with 22qDS were informed by the child's and parents' performance on various assessments of cognition.
Results: Â Two separate models of language and visual motor age equivalents were created. We identified that both age and sex had a significant effect on the developmental trajectory of the child. In terms of sex, we found that gender was significantly associated with path of developmental trajectory in the language domains.
Conclusions: Overall, this project indicates initial evidence that mapping of developmental trajectories can lead to improved prediction of future outcomes including severity of cognitive impairment and presence of clinical ASD. Future results of our study has the potential to lead to an improved understanding of the quantitative effects of genetics, as well as behavioral and medical factors, on phenotypic outcome.

148 **108.148** Neurobehavioral Traits in Family Members Inform GENE Discovery in ASD

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Background: Autism spectrum disorder (ASD) is highly prevalent and has a complex genetic architecture. The ASD phenotype is multi-dimensional and variable.Changes in diagnostic criteria have contributed to an increased phenotypic heterogeneity. We aim to identify a narrower ASD phenotype based on core ASD features. Furthermore, it has been demonstrated that neuropsychiatric (NPD) and neurodevelopmental (NDD) disorders are part of a connected molecular system. There may be up to 4000 genes contributing to their etiology. Individuals with ASD harbor several different risk alleles and symptoms overlap across NPD and NDD.They are not single biological identities, rather a spectrum of conditions.
Objectives: We hypothetize that inherited molecular complexity featuring the presence of several NPD and NDD within the same family, together with sub clinical ASD features among family members, concentrates autistic liability across generations with common genetic drivers.
Methods: We developed a Quantitative Autism Score (QAS) using items from the ADI-R which consistently discriminate ASD from non-ASD, occur early in development and remain stable throughout changing diagnostic criteria. We then divided our sample (520 ASD individuals) in 2 groups, according to their family history of NPD, NDD and sub clinical autistic features in first degree relatives. Our first group consisted of 185 individuals with ASD from families with a high burden of NPD, NDD and sub clinical autistic features in first degree relatives. Our comparison group consisted of 335 individuals with ASD from families with a very low or no burden of NPD, NDD or subclinical autistic features in first degree relatives. The outcome measure was the QAS score to try to capture a more homogeneous phenotypic manifestation. We conducted a SKAT-O gene-based test on WES data available; we analyzed the 2 groups separately.
Results: in the first group analyzed, LMAN1L, GREB1L and EIF4A2 were significant (p-value=9.7E-06; p-value=6.4E-05 and p-value=6.8E-05 respectively).LMAN1L was also the most significant gene when only predicted damaging variants were analyzed (P-value=2.4E-05). LMAN1L exerts its function in glycoprotein transportation and organelle targeting, an important mechanism that if defective, increases unfolded proteins within cells. EIF42A was reported to be overexpressed in fronto-temporal dementia and down-regulated in schizophrenia. In the comparison group PMFBP1, MIS18A and RPL14 were significant (p-value=3.2E-06; p-value=7.2E-05 and p-value=9.9E-05 respectively). When only predicted damaging variants were analyzed, SLC35F1 was the most significant gene (p-value=5.7E-05). PMFBP1 is involved in the general organization of the cellular cytoskeleton and localized in the 16q22,1-q22.3 CNV-enriched region in ASD cases. RPL14 is reported to interact with other genes in mice models of ASD.
Conclusions: our two groups consisted of individuals with a very homogenous phenotypic manifestation of ASD as measured by our newly developed QAS. They differed in their autistic liability derived from family history. Two different sets of genes were found significant, pointing towards the presence of different mechanisms/different genes leading to ASD. Refining the ASD phenotype using the QAS and considering family liability allowed for identification of several potential risk genes. This novel approach is the first step towards dissecting a polygenic and multi-dimensional condition to clarify its underlying biology.

149 **108.149** Phenotypic Description of Individuals with PTEN Mutations, ASD and Macrocephaly

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Background: Autism spectrum disorder (ASD) is a challenging neurodevelopmental disorder, with a multifactorial origin and a complex inheritance. Studying proven susceptibility genes and working on clinical endophenotypes is needed to define more valid genotype-phenotype relationships. *PTEN* is a tumor suppressor gene whose inactivation results in upregulation of the PI3K/AKT signaling pathway, affecting multiple cellular processes, namely cell growth and proliferation. *PTEN* germline mutations are associated with tumor susceptibility and neurodevelopmental disorders such as autism. They have been reported in up to 20% of children diagnosed with ASD and major macrocephaly. Studies have emphasized macrocephaly as a consistently encountered clinical finding amongst ASD, estimated in about 15%. Hence, a *PTEN* mutation testing is a major consideration in cases of ASD and macrocephaly.
Objectives: To report a subset of individuals with a *PTEN* germline mutation and both ASD and macrocephaly.
Methods: We describe three Caucasian-portuguese patients, two male, with current ages 5, 7 and 13 years old, with a diagnosis of ASD (positive score for both ADI-R and ADOS, and fulfilment of DSM-5 criteria) and macrocephaly (ranging from +3SD to +4SD). Moreover, these ASD children underwent intellectual and functional adaptive evaluations with *Griffiths Mental Development Scale* and *Vineland Adaptive Behaviour Scale* (VABS), respectively. Besides PTEN molecular analysis, genetic testing was performed to rule out other medical conditions.
Results: Our findings revealed significant phenotypical heterogeneity. Three *PTEN* mutations were found: a missense variant c.737C>T (p.Pro246Leu) heterozygous in exon 7 (Patient 1), a *de novo* duplication in exon 6 [c.493-?_634+?(2)] (Patient 2), and a missense mutation c.359C>A (p.Ala120Glu) heterozygous in exon 5 (Patient 3). Brain Magnetic Resonance Imaging showed enlarged perivascular spaces and white matter abnormalities of both cerebral hemispheres (Patient 1) and had no brain alterations in the other two subjects. All the three ASD subjects had moderate to severe intellectual disability and VABS functional adaptive profiles were lower than the expected for their age (ranging from -2SD (Patient 2) to -3SD (Patients 1 and 3). Noteworthy, all patients have already initiated cancer risk surveillance.
Conclusions: We report concordant data with contemporaneous investigation on the field and add a novel mutation, not yet described, with clinical evidence strongly pointing to the pathogenicity of this variant. We also intend to present functional studies that are being done. A multidisciplinary cancer surveillance regimen extended to adulthood is mandatory in all cases of *PTEN* mutation. Additional research in ASD patients with known *PTEN* mutation etiology is necessary to enhance knowledge and disclose the full potential of target therapeutics in this neurobehavioral syndrome.

150 **108.150** Placental DNA Methylation in Relation to Maternal Periconceptional Prenatal Vitamin Use and Child Outcomes in the Marbles Prospective Autism Study

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Background: Placental tissue, usually discarded at birth, is a potential rich source of for epigenetic biomarkers that the interface of genetic risk and in utero exposures in autism spectrum disorders (ASD). In addition, maternal use of prenatal vitamins containing the methyl donor folic acid could alter placental methylation in persistent ways that influence neurodevelopment, especially during a period of dynamic methylation and reprogramming around conception. Compared with other human tissues, placenta contains partially methylated domains (PMDs) that are more similar to oocytes and pre-implantation stages of development.
Objectives: This study was designed to identify regions of differential DNA methylation in placenta from a prospective ASD study in high-risk families. We also studied the relationship between maternal prenatal vitamin use and DNA methylation.
Methods: MARBLES (Markers of Autism Risk in Babies-Learning Early Signs) study involves families with at least one child with ASD so subsequent children were at significantly higher risk (nearly 18%) of having another autistic child and were planning another pregnancy. Mothers were interviewed about prenatal vitamin use during a new pregnancy. Placentas were collected for the younger siblings who were followed until they were 3 years old and clinically diagnosed with ASD or typical development (TD). MethylC-seq was performed on DNA isolated from 20 ASD and 21 TD male placentas using Illumina next-generation sequencing on HiSeq 2000 machine with one sample per lane using single-end 100 bp sequencing. We identified differentially methylated regions (DMR) using the DMR finder approach based on bsseq R package.
Results: Two DMRs showed significant differences after FDR correction between ASD and TD selected by DMR finder based on MethyC-seq data and validated by pyrosequencing (Fig. 1). One DMR that was hypomethylated in ASD compared with TD showed a positive association between prenatal vitamins taken during the first pregnancy month and percent methylation. The other DMR was hypermethylated and its methylation tended to be negatively associated with prenatal vitamin intake. Both DMRs were also associated with Mullen Scales of Early Learning on four subscales categories (Visual Reception, Fine Motor, Receptive Language and Expressive Language) and the Early Learning Composite (Fig. 2).
Conclusions: This relatively small study of DNA methylation differences in placental samples from the MARBLES prospective study identified two high confidence DMRs that could be useful in assessing risk for ASD at birth and determining the impact of maternal prenatal vitamin usage on ASD occurrence in offspring.

151 **108.151** Possible Maternally Acting Gene Alleles (MAGAs) in Autism

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Background: Â Maternally Acting Gene Alleles (MAGAs) may act in maternal tissues prenatally to alter fetal environment or in the developing embryo prior to the maternal – zygote transition altering development and affecting offspring phenotype, independently of whether or not they are inherited by the fetus. At least 169 MAGAs have been reported, mostly in neurodevelopmental disorders.
Objectives: Â Here, we carried out an analysis of possible MAGAs in SSC trios.
Methods: Â We used families of the Simons Simplex Collection (SSC) Version 14 that were largely genotyped on the Illumina Human 1M duo array for imputation of un-genotyped SNPs and subsequent analysis using the Weinberg log-linear method through a convenient implementation in EMIM.
Results: One SNP, while not reaching genome wide significance, was of particular interest. SNP rs6482968, Chr10:129525038, 5' of *FOXI2* gave a corrected p-value of 1.02E−6 with a large number of SNPs in strong LD (r2 > 0.80) and below p-value 1.00E-4, a threshold used for suggestive results.
Conclusions: *FOXI2,* which belongs to the forkhead-box (FOX) superfamily of transcription factors makes an interesting candidate for a maternally acting allele. It has been reported in a model system that *Foxi2* derived from maternal mRNA is an activator of zygotic *Foxi1e*, an important factor in the early expression of ectoderm specific genes and so may be important in the maternal-zygotic transition. *FOXI2* and the gene region have been previously implicated in autism. It has been implicated in Expression quantitative trait loci mapping (eQTLs) in autism. Additionally, CNV's that span this region have been described in individuals with developmental disorders including autism spectrum disorder. This large group of SNPs may represent a haplotype but since the Weinberg method looks at asymmetries in paternal vs. maternal transmissions, it can not be excluded that our results may be due to maternally derived CNV's. A different SNP 5' to *FOXI2* and our index SNP gave a p-value of 7.66E-05 in a case GWAS analysis. Others have reported increased *FOXI2* mRNA levels in post mortem autism brains. This may suggest that it acts both maternally and in her child. Other forkhead genes have also been implicated in autism such as *FOXP2.* Last, it has been reported that *FOXI2* is a target for 3 miRNA's previously implicated in autism. Follow up studies are needed to confirm these results.

152 **108.152** Prenatal Air Pollution Exposure and Cord Blood DNA Methylation in the Early Autism Risk Longitudinal Investigation (EARLI)

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Background: Several epidemiological studies have shown associations between prenatal exposure to environmental contaminants such as air pollution and an increased risk for autism spectrum disorder (ASD) and adverse neurodevelopment in children. While the underlying biological mechanisms of these exposures in relation to disease risk are not well characterized, it is possible that epigenetic mechanisms such as DNA methylation can mediate the effects of prenatal exposures on neurodevelopmental outcomes.
Objectives: Our work seeks to investigate associations between prenatal exposure to criteria air pollutants (particulate matter less than 2.5 ($PM_{2.5}$) and 10 microns in diameter (PM_{10}), nitrogen dioxide (NO_2) and ozone (O_3)) and DNA methylation at birth in order to identify and characterize potential biological mechanisms that might explain the observed relationships between air pollution exposure and increased ASD risk.
Methods: DNA was extracted from 175 umbilical cord blood samples from babies born in the ASD enriched-risk pregnancy cohort, the Early Autism Risk Longitudinal Investigation (EARLI), at 4 different study sites (Drexel University, University of California Davis & MIND Institute, Johns Hopkins University, and Kaiser Permanente in Northern California). Genome-wide DNA methylation was then assessed using the Illumina Infinium HumanMethylation450 bead chip array (450k). We assigned prenatal exposure to ambient levels of criteria pollutants for each pregnancy address location reported by EARLI mothers based on data collected from the Environmental Protection Agency's AirNOW monitoring network using inverse distance weighting. We performed single-site and region-based statistical analyses to identify genomic locations showing differential methylation associated with exposures. We further examined if such differences are associated with ASD phenotype.
Results: Air pollution exposure and methylation data were available for 158 cord blood samples. We report the top-ranked differentially methylated regions and individual CpG loci and explore the potential functional implications of these genomic sites in relation to ASD risk and neurodevelopment.
Conclusions: Our work helps to describe environmental exposure biology generally and also how in utero exposure to air pollution might contribute to the etiology of ASD and neurocognitive development.

153 **108.153** Prioritization of ASD-Associated Genes By Variant Annotation Identifies Trends in Genetic Variant Discovery

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Background:
The search for genetic causes of autism spectrum disorders (ASD) has led to the identification of hundreds of genes containing thousands of variants that differ in their mode of inheritance, effect size, and frequency in cases and controls, and exhibit a broad range of putative functional effects. These data are richly annotated in AutDB (also known as SFARI Gene), an open-access database for ASD-associated genetic variation.
Objectives:
We previously described a scoring algorithm for the prioritization of candidate genes based on the cumulative strength of evidence from each ASD-associated variant curated in AutDB. Here, we present the results using an expanded and up-to-date dataset of ASD-associated variants.
Methods:
A total of 1176 annotated research articles were analyzed to generate a dataset of 3557 ASD-associated rare variants and 861 ASD-associated common variants distributed across 787 candidate genes (September 2016 data freeze). Under our algorithm, each individual variant is manually annotated with multiple attributes extracted from the original report, followed by score assignment using a set of standardized scoring parameters that were summed up to yield a single score for each gene in the database. We also performed a time-course analysis of ASD-associated gene scores to identify trends in rare and common variant discovery and assess how newly discovered variants affected the scores of the genes in which they were identified.
Results:
We observed remarkable variation in gene scores resulting in a distribution with a mean gene score of 23.53 ± 38.73. We were able to identify a set of 14 high confidence candidate genes with scores deviating more than two standard deviations (SDs) from the mean score of all genes. The gene scores generated by our approach once again significantly correlated with other ASD candidate gene ranking systems, including the expert-mediated SFARI Gene scoring initiative and gene prioritization based on Transmission and De Novo Association (TADA) analysis of ASD cohorts. Finally, time course analysis of ASD-associated gene scores identified a subset of candidate genes that showed a marked increase in gene score based on the identification of novel genetic variants in those genes.
Conclusions:
Altogether, our scoring algorithm continues to provide a framework for assessment of diverse types of ASD-associated genetic variants that are likely to be important for defining the genetic risk architecture of ASD.

154 **108.154** Quantification of FMRP in Human and Mouse Tissues By Capture Immunoassay

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Background: The Fragile X syndrome is a leading inherited cause of ASD. The Fragile X syndrome is due to mutations of the FMR1 gene that result in the lack of gene expression and the loss of its gene product the fragile X mental retardation protein (FMRP).
Objectives: To develop a screening test for FMRP.
Methods: We have developed a rapid, highly sensitive method for quantifying FMRP from dried blood spots and lymphocytes. This assay uses new FMRP antibodies, a human specific mAb 6B8 (Biolegend) and rabbit polyclonal R477, a bacterially expressed abbreviated FMRP standard, and a Luminex platform to quantify FMRP.
Results:
The assay readily distinguishes between samples from males with fragile X full mutations and samples from normal males. It also differentiates mosaic from non-mosaic full-mutation male samples. We have employed the assay to screen 2000 newborn dried blood spots (DBS) and present their distribution. We also applied the assay in a retrospective study of 76 newborn DBS that had been stored for an extended period and included full mutation males as well as normal individuals. We were able to correctly identify all 5 known male fragile X positive cases among samples stored up to 47 months. Variable amount of FMRP are detected in typical individuals. In DBS samples, normalization of FMRP levels to the number of leukocytes reduced this variability and could allow to distinguish premutation carriers from typical individuals.
Using human and mouse detecting mAb 5C2 (Biolegend) and R477, we have also developed a similar immunoassay for the quantification of Fmrp in mouse tissues. This assay was used to quantify Fmrp in the brainstem, cerebellum, hippocampus, and cortex two strains of mice (C57BL and FVB) in seven and ten week-old animals, showing developmental variations exist.
Conclusions: A rapid qualitative assay has been developed for the diagnosis of Fragile-X Syndrome. This sensitive assay allows for the screening of newborn infants using routinely collected dried blood spots. The assay will also allow further studies on variations of mouse Fmrp expression in different models and organs.

155 **108.155** Role of ANK2 in Autism Spectrum Disorder

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Background:
ANK2 encodes a member of the ankyrin family of proteins (Ankyrin B) that link integral membrane proteins (e.g. L1CAM) to the underlying spectrin-actin cytoskeleton. Ankyrins play key roles in activities such as cell motility, activation, proliferation, cell-cell contact and the maintenance of specialized plasma membrane domains. Loss-of-function variants in *ANK2*cause a dominantly-inherited cardiac arrhythmia with increased risk for sudden cardiac death, initially termed type 4 long QT Syndrome, and more recently renamed the “Ankyrin-B” Syndrome. Recent next generation DNA sequencing projects in autism spectrum disorder (ASD) cohorts (the Simons Simplex Collection) have revealed several heterozygous de novo ANK2 missense and nonsense mutations marking ANK2 as a ‘high-confidence’ autism candidate gene. Additionally, our lab has identified individuals with ANK2 sequence changes who not only have cognitive and behavioral deficits, but also have abnormalities of the corpus callosum. These genetic findings highlight the importance of ANK2 in neurodevelopment, but how mutations in ANK2 lead to these brain disorders is still unknown.
Objectives:
To determine the interaction between ANK2 and L1CAM and its role in ASD development and abnormalities of the corpus callosum.
Methods:
whole genome sequencing and breaking point analysis were performed in a patient with a balanced chromosomal translocation t (4; 8) (q25; q23), quantitative PCR and Western blot were used to compare ANK2 and L1CAM expression among ASD patients from the SSC cohort. Immunohistochemistry (IHC) was used to show overlapping expression pattern of ANK2 and L1CAM during corpus callosum development in mouse.
Results:
We reported an expected and significant decrease in expression of ANK2 mRNA and protein in patient compared to control PBMC’s. We also investigated the abundance of the neuronal adhesion protein, L1CAM. We found that L1CAM protein abundance is decreased in patients with ANK2 mutations (one with a balanced chromosomal translocation through ANK2 t (4; 8) (q25; q23), and in two other ASD patients with nonsense mutations in ANK2) and that L1CAM expression is rescued after transient transfection of ANK2 into a cell line from one patient carrying a nonsense mutation in ANK2.
Conclusions:
Our results suggest that disruption of the normal interaction and balance between ANK2 and L1CAM may play an important role in ASD and other neurodevelopmental disorders such as agenesis of the corpus callosum (ACC). Moreover, this linkage between ACC and ASD has implications for the mechanistic overlap for these two groups of disorders.

156 **108.156** Sexually Dimorphic Regulation of Norepinephrine Projection Neurons:Â Transcriptional Profiling of Mouse Locus Coeruleus

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Background: A number of neuropsychiatric diseases demonstrate sex-biased incidence, including ADHD and autism. The locus coeruleus (LC), which sends noradrenergic projections throughout the brain, is known to demonstrate sex-specific responses to stress-related molecules like corticotropin-releasing factor at both cellular and behavioral levels (Curtis et al 06, Bangasser et al 16). Moreover, the engrailed-2 (En2) knockout mouse—an animal model for autism spectrum disorders—has been demonstrated to have sex specific deficiencies in norepinephrine signaling (Genestine et al 2015). However, the full extent and clinical significance of sex differences in the LC have not been defined. We employed Translating Ribosome Affinity Purification (TRAP) to selectively profile the transcriptome of mouse LC, providing a new look into the breadth of—and cellular functions implicated by—sex-specific gene expression in the LC.
Objectives:

1. Identify genes whose expression is unique to the LC (among hindbrain cells).
2. Identify genes expressed in a sex-specific manner within the mouse LC.
3. Verify expression patterns using existing resources, as well as immunohistochemistry (IHC) and *in-situ* hybridization (ISH).
4. Identify functional consequences of sex-specific gene expression.

Methods: TRAP utilizes transgenic mice expressing a GFP-tagged ribosomal subunit under the control of a cell-type specific promoter (in this case, the Slc6a2, aka NET, the norepeniphrine transporter). Affinity purification of GFP-conjugated ribosomes from brain homogenate allows for collection of mRNAs being translated at the time of collection in the LC, and subsequent quantification—for analysis of cell-type specific gene expression and comparison of cell-type specific expression between the sexes. Using the Allen Brain Atlas, IHC, and ISH, and electrophysiology, we validate our findings of LC-specific gene expression.
Results: We identified 188 transcripts enriched in the LC compared to the rest of the hindbrain, and validated these with independent methods. Moreover, we identified 84 transcripts significantly enriched in female LC, and 75 enriched in male LC, suggesting broad mechanisms of sex-specific gene expression and cellular function. In contrast, we find almost no (≤10 total) genes with sex-specific expression in TRAP of serotonergic neurons, indicating the LC is strikingly dimorphic by comparison. Among the genes we found to be both LC-specific and differentially expressed (>2-fold enriched in females) was a prostaglandin receptor, Ptger3. Electrophysiology of LC neurons in the presence of a Ptger3 agonist, sulprostone, revealed a robust response of female LC neurons compared to male LC neurons.
Conclusions: A comprehensive analysis of gene utilization has not been performed on the LC. Here, we identify transcripts uniquely expressed in LC and demonstrate that the LC has robust of sex differences, which may underlie sexually dimorphic behaviors in LC related functions such as response to stress, novelty, and attention. Moreover, this work raises the question of whether dimorphic regulation of the norepinephrine signaling in the brain might affect dosing and efficacy of noradrenergic drugs in the treatment of neurodevelopmental and psychiatric diseases. Finally, we have discovered a receptor that may be used to alter noradrenergic signaling in a sex specific manner.

157 **108.157** The Challenge of Whole Exome Sequencing As a Molecular Diagnosis for ASD

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Background: The search for an objective diagnosis for autism spectrum disorder (ASD) is a major concern of the scientific community. The availability of new molecular tests increased the expectations for an etiologic diagnosis of ASD. Nowadays, it would be expected that these tests would allow a conclusive result in about 20-30% of the cases. Whole exome sequencing (WES) are being offered as an approach for ASD diagnosis, but because of the amount of data and difficulties in interpreting the clinical significance of the variants in most situations it is a challenge to prioritize variants and return a final conclusive report for the family. In this context to determine the actual power of the WES as a diagnostic test is imperative.
Objectives: To investigate the specificity and sensitivity of WES as a molecular test for ASD.
Methods: 40 individuals with ASD, 115 individuals with other clinical diagnosis than ASD and 609 higid individuals with more than 60 years old. The sequencing was made with Illumina's platform and alignment were performed with bwa and variant calling for ASD and 115 control samples (OSC) together with Unified Genotyper from GATK, and the 609 control(HSC) were called separately with the same software. Annotation was performed with ANNOVAR and internal pipelines. The variants were filtered for 243 genes present in SFARI database from the three first categories and syndromic. Variants of Low Quality, outside exonic regions, genotype calling under 99, and minor alelle frequency inferior to 0,3 were removed from the analysis. Variants were separated by frequency in 3 groups, above 0.05, between 0.05 and 0.01 and below 0.01. Each individual had their variants accounted and prioritized, loss-of-function (LoF) variants (frameshift, stopgain/loss and splicing site) were divided into two groups, one considering all the variants in the SFARI genes, and other taking into account the ExAC LoF intolerance genes, creating a subset of 151 genes from SFARI. Missense variants were prioritized using SPRING software, and only those variants with p-value below 1.10^{-12}, were included. False positive and false negative rates were calculated for each type of variants and ROC curves were plotted.
Results: There were no difference in the mean number of LoF (ASD: mean 6.01, sd 6.31; OSC: mean 6.90, sd7.10; HSC: mean 5.92, sd5.06), ExAC LoF (ASD: mean 3.69, sd 4.01; OSC: mean 4.17, sd 5.01; HSC: mean 3.60,sd 3.93), and missense variants between the groups (ASD:mean 6.07, sd 3.34; OSC: mean 6.44, sd 3.66; HSC: mean 6.59, sd 3.49). The false positive rates and false negative rates for all the groups were above 50%. The area under de ROC curve were very close to 0,5 in all occasions.
Conclusions: The prioritized methods chosen above were not sufficient to discriminate between individuals with ASD and controls. Further studies must be completed in order to create an effective analysis for WES in patients with ASD. Research supported by FAPESP-CEPID, CNPq, INCT.

158 **108.158** The Feature Landscape of Autism Risk Genes Indicates Their Enrichment in Developmental Regulation

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Background: While there have been many studies investigating the functional enrichment of classes of autism risk genes, few have studied their structural commonalities as an additional indicator of function.
Objectives: The purpose of this study is to investigate characteristic features of autism risk genes in order to better understand the function and evolutionary history of conserved elements and features of these genes.
Methods: Utilizing various bioinformatics approaches, we have studied commonalities across different genomic features, such as gene length, protein complexity, and intronic regulatory content.
Results: We find that autism risk genes tend to be highly conserved and have low allelic variability (i.e., low mutation tolerance). In addition, compared to whole genome control (WGC), these mutation-intolerant genes display long gene length, long peptides indicative of enriched protein complexity, increased numbers of transcript variants, and enrichment of both intronic conserved noncoding elements (CNE) and transposable elements. These latter two features in particular are likely indicative of complex internal regulatory content in these autism risk genes. Most of the structural and functional features investigated here typify gene classes involved in the regulation of development and transcription, as has been reported in previous studies such as Sironi et al (2005).
Conclusions: As we have shown here, gene function is reflected, not only in the structure of the protein, but the structure of the gene as well. From this vantage point, we add further support to the growing body of evidence that suggests that autism risk genes of major effect are enriched in developmental regulation and transcription, both of which help to control the timing of neurogenesis, migration, neuritogenesis, synaptogenesis, and ongoing plasticity (Casanova et al., 2016).

159 **108.159** The Genetic Architecture of Autism Spectrum Disorders in the Faroe Islands

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Background:
Autism spectrum disorders (ASD) are a group of neuropsychiatric disorders characterized by deficits in social communication, as well as presence of restricted interests, stereotyped and repetitive behaviors. The biological causes of ASD remain largely unknown mostly because of the clinical and genetic heterogeneity of this complex condition.
Objectives:
This project aims to characterize the genetic architecture of ASD in the Faroe islands located between the Norwegian Sea and the North Atlantic Ocean, approximately half distance from Norway and Iceland.
Methods:
We obtained the genetic profiles of 380 individuals from the Faroe Islands (36 patients with ASD, 129 relatives and 215 controls) using genome-wide genotyping of >5 millions SNPs and whole-exome sequencing.
Results:
We first analysed the contribution of *de novo* mutations (CNVs, SNVs and indels) in 28 patients with ASD. For 3 patients, we identified *de novo* mutations in known ASD-risk genes/loci : 1 22q11.1 deletion, 1 deletion of *NRXN1*, and 1 damaging *MECP2* missense mutation. We also identified inherited rare exonic CNVs and SNVs altering genes previously associated with ASD (*ADNP*, *BCL9*, *IMMP2L*, *TBL1X*, *TBL1XR1, ACACA, ROBO1, RARS2 and ALDH3A2*). As expected, we observed a relatively higher homozygosity compared to other world-wide populations (P<0.0001). Interestingly, patients with ASD had a slightly higher inbreeding coefficient compared with controls (F_{ASD}=0.007; $F_{Controls}$= -0.004; P=0.0002), suggesting that, in a subset of patients, recessive mutations could contribute to the increase risk of having ASD. In a consanguineous family, we found a rare homozygous missense variant affecting *KIRREL3,* a member of the nephrin-like protein family. Finally, our analysis also revealed new compelling candidate genes for ASD such as *IQSEC3*, a guanine nucleotide exchange factor highly expressed in the brain, *RIMS4,* a key regulator for neuronal arborisation and *SMG7*, a gene involved in mRNA non-sense mediated decay.
Conclusions:
In summary, we identified deleterious mutations in known ASD-risk genes in 36% of the patients indicating that the genetic architecture of ASD in the Faroe Islands might not be very different from other populations. Remarkably, recessive mutations might not increase dramatically the risk of ASD in the genetic isolate. Further analyses are currently in progress to better understand the interplay between the common and the rare variants in the susceptibility and the severity of ASD in these patients.

160 **108.160** The Genetics of Educational Attainment, Autism, and Schizophrenia Show Points of Convergence

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Background: Different studies have identified a link between educational attainment and psychiatric conditions like schizophrenia and autism. Biologically, this relationship can be construed in terms of two different but not necessarily mutually exclusive hypothesis: Genes for educational attainment (edu genes) are more frequently mutated in conditions like schizophrenia and autism, or genes for educational attainment interact with downstream risk pathways for autism and schizophrenia.
Objectives: Here, we investigate both the hypothesis using summary data available from large genome-wide association studies and transcriptome studies.
Methods: We examine the relationship between genes robustly associated with edu genes and genes and pathways implicated in autism and schizophrenia. We use genes previously identified for educational attainment using DEPICT, thereby restricting our analysis to Single Nucleotide Polymorphisms (SNPs) with $P < 1x10^{-5}$. We investigate if these genes are signficantly enriched in transcriptional modules for schizophrenia, autism, and general cognition.
Results: We show that edu genes are highly intolerant to loss of function and are enriched in a gene-coexpression module for cognition. We identify that genes for educational attainment are more frequently mutated in autism and developmental disorders than expected by chance. We also find evidence for enrichment of edu genes in a module dysregulated in schizophrenia.
Conclusions: In conclusion, our results highlight a role for edu genes in both upstream and downstream hypotheses.

161 **108.161** Towards a Pathway Driven Clinical-Molecular Framework for Classifying Neurodevelopmental Disorders

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Background:
The current clinical classification system of neurodevelopmental disorders is outdated, offering little insight into the molecular pathophysiology of disease that would guide targeted treatment. Neurodevelopmental disorders share common molecular and cellular pathways of dysregulation and recently, there has been a move toward gene-specific classification of neurodevelopmental disease, however, classification at this level of detail is not immediately clinically useful.
Objectives:
Â ToÂ propose an intermediate classification scheme based on molecular and cellular pathways and their clinical features.
Methods:
We compiled a list of all OMIM genes and syndromes with the keywords 'autism' and 'epilepsy or seizure' and used gene set enrichment analysis to determine shared pathways significantly over-represented among this set of genes (with Benjamini-corrected p-value < 0.05). We manually curated all one-hundred twelve OMIM entries into molecular pathways, and then compared the clinical features of syndromes within these pathways.
Results:
Ninety-eight of one-hundred twelve OMIM entries curated enriched for one of three pathways: transcriptional regulation, molecular transport, or cellular synaptic function. Transcriptional regulation was the most commonly enriched pathway (n=50), and included 23 recognized syndromes. Syndromes enriching for the transcriptional regulation pathway had the highest incidence of systemic symptoms (n=20/23), the molecular transport group had the highest incidence of psychiatric symptoms (n=5/6), and the cellular transport pathway the highest incidence of motor symptoms (n=11/13).
Conclusions:
A classification system such as this would allow clinicians to leverage the expanding genetic information in a clinically-actionable manner, providing information about disease pathophysiology and be used to guide treatment and influence the development of new therapies.

162 **108.162** Transcriptome Analysis in Neuronal Cells of an Autistic Patient with 17p13.3 Duplication: Identification of Upregulation of Ywhae and Crk and Possible Contributor Factors for Penetrance.

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Background: Duplications in chromosomic region 17p13.3 have been identified in individuals with autism spectrum disorders (ASD) and intellectual disability (ID). However, 17p13.3 duplication carriers present incomplete penetrance and significant variability of the phenotype, suggesting that other genetic and/or environmental factors might be necessary for clinical manifestation. Association of genes in this region to ASD and ID, particularly *YWHAE* and *CRK*, is based on analysis of overlapping duplications and some sporadic functional studies showing the relevance of such genes to neurodevelopment, but no study has been conducted using the cells of the patients so far.
Objectives: In this study, we aimed to investigate the consequences of 17p13.3 duplication for gene expression using neuronal cells derived from an autistic individual, as well as to explore other possible factors that might be contributing for the penetrance of the phenotype in this individual.
Methods: Array-CGH was used to identify and delineate the boundaries of the duplication. Induced pluripotent stem cells (iPSC) were derived from stem cells from exfoliated teeth from the patient and 6 controls, and next differentiated in neuronal progenitor cells (NPCs) and neurons. We generated transcriptome data of these cells as well as exome data from DNA obtained from patient's peripheral blood cells.
Results: Â We have identified an autistic individual that harbors a *de novo* 345kb duplication in 17p13.3, spanning the genes *ABR*, *BHLHA9, TUSC5, YWHAE, CRK* and *MYO1C*. In accordance to phenotypic descriptions of other patients with duplications of similar size and location, the current case present only mild learning disabilities and mild autistic features. Our transcriptome analysis revealed 65 differentially expressed genes in patient's NPCs compared to control NPCs, among which *YWHAE* and *CRK* was found as upregulated. We then searched for rare potential pathogenic variants in the remaining 63 differentially expressed genes, aiming to find other genetic alterations that could contribute for the penetrance of the phenotype. Interestingly, we identified a rare stop codon mutation in a downregulated gene, *NGDN*, which codifies an EIF4E-binding protein that regulates translation during nervous system development. Indeed, comparing genotypes found in exome and RNAseq data, we could identify a bias in the expression towards the normal allele, indicating the existence of RNA decay. Investigation of *YWHAE, CRK* and *NGDN* expression levels in the iPSC-derived neurons from the patient confirmed the same changes observed in NPCs.
Conclusions:
Our results add further support for the role of *YWHAE* and *CRK* for the manifestation of neurodevelopmental disorders presented by 17p13.3 duplication carriers. Also, we suggest that a loss of function mutation in *NGDN* may acts as the second hit necessary for the penetrance of ASD in the presence of 17p13.3 duplication.

163 **108.163** Umbilical Cord Blood Androgen Related Gene Expression and Risk of Autism Spectrum Disorder in an Enriched Pregnancy Cohort

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Background: Autism spectrum disorder (ASD) affects more than 1% of children in the United States. The male-to-female ASD prevalence ratio is roughly 4:1, but the biological mechanisms are poorly understood. An explicit focus on etiologic pathways underlying this sex difference, such as the hormonal *in utero*environment, may help elucidate causes of ASD.
Objectives: To examine the relationship between androgen levels and RNA expression in cord blood and the relationship to ASD diagnosis at 36-months.
Methods: Genome-wide RNA expression was measured in 155 cord blood samples from the Early Autism Risk Longitudinal Investigation (EARLI), an enriched-risk pregnancy cohort of families with a child previously diagnosed with ASD. Families were recruited from 4 study sites (Drexel University, University of California Davis & MIND Institute, Johns Hopkins University, and Kaiser Permanente in Northern California). RNA expression was assessed using the Affymetrix Human Gene 2.0 array. Cord blood androgen levels (testosterone, androstenedione, dehydroepiandrosterone) were also measured. Standard RNA data quality control and RMA normalization pipelines were implemented. Surrogate variable analysis was used to adjust for potential cell-type and batch effects. We tested for gene expression differences by androgen levels stratified by sex. We further examined whether expression of androgen related genes, including steroidogenic pathway genes related to androgen synthesis and degradation, were associated with ASD risk. ASD diagnosis at 36-months and cord blood RNA and androgen data were available in 116 samples (20 ASD, 46 non-typical development, and 50 typical development).
Results: Cord blood gene expression differences between typically developing children and children with ASD did not reach genome wide significance (FDR q-value<0.05) adjusting for multiple comparisons in either sex. We will report top-ranked differentially expressed genes by androgen and will explore implicated regions for their potential functional relevance to ASD risk.
Conclusions: This study describes differences in RNA expression by androgen levels, and further examines the role of androgen-related genes in ASD risk, which may play a role in the ASD sex disparity.

164 **108.164** Variable Expressivity of Neurodevelopmental Disturbances Due to Loss-of-Function of AP1S2

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Background: Autism spectrum disorder (ASD) is a common neurodevelopmental disorder phenotypically and genetically heterogeneous. One of the most concurrent conditions in ASD individuals is intellectual disability (ID), which affects approximately 50% of the cases. Among the ASD familial cases, which represent less than 20% of the families, it has been recognized all Mendelian patterns of inheritance. The genetic factors associated with ASD familial cases are still unclear in most of them. Thus, it is essential to analyze family history and pedigree to figure out the inheritance model that best fit to each family, and, consecutively, conduct genetic analysis in order to identify the major pathogenic event leading to the phenotype.
Objectives: To investigate genetic variants that would explain the ASD and ID segregating in 4 generations in a family with an X-linked inheritance pattern.
Methods: We selected two distant related cousins (individuals IV-2 and IV-4 in Figure 1), which belong to a family (Family F8293) with a total of 3 autistic individuals (individuals III-7, IV-2 and IV-4 in Figure 1) and 4 ID affected individuals (individuals II-4, II-5, III-6 and III-8 in Figure 1), to perform whole-exome sequencing (WES) using the Nextera Rapid Capture Exome kit (Illumina) for library preparation and sequencing on a HighSeq 2500 (Illumina). The alignment, processing, variant calling and annotation were carried out on BWA, GATK and ANNOVAR. To filter possible pathogenic variants we used a MAF<0.01, adopting as references 1000g, 6500 exomes and Brazilian control 60+ databases. Sanger sequencing was used to investigate if the selected candidate variants were shared among the other members of the family.
Results: We first search for shared variants between both cousins, but we did not detect any X-linked or autosomal variant that could explain the phenotype. Next, we searched for loss of function variants (LoFs) in brain expressed genes located in the chromosome X that were exclusive of each affected individual. In individual IV-4 we identified a stop codon variant in *AP1S2*. We verified that the same variant was shared among all other affected individuals, except for individual IV-2. *AP1S2* is already associated with syndromic mental retardation, but it had not been linked to ASD yet. No relevant LoF variant in the X-chromosome or in autosomes of IV-2 was identified.
Conclusions: Our findings show the complexity of the analysis of each ASD family and highlight the relevance of another ID-associated gene to ASD.

165 **108.165** Visualising Multiple Hits in Autism Spectrum Disorders Using Whole Genome Sequencing and Protein-Protein Interaction Networks

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Background: The biological causes of autism spectrum disorders (ASD) remain largely unknown mostly because of the high clinical and genetic heterogeneity. Furthermore, many studies indicated that, in a single patient, multiple hits affecting different genes/pathways might underlie the increased risk to have ASD. Several tools, such as Cytoscape, exist to visualize protein-protein interactions networks, but no application was designed to visualise variants affecting these networks.
Objectives: We aimed at developing a tool to help geneticists to visualise both protein-protein interactions and whole genome/exome data. This tool should help identifying multiple hits in individuals with ASD and providing a very precise characterization of each variants.
Methods: We sequenced the whole genome of 152 individuals from simplex and multiplex families with autism (57 patients, 68 parents and 51 relatives). We then designed GRAVITY a new Cytoscape App to rapidly visualise variants affecting ASD-risk genes (for example the SFARI gene list) or pathways (for example the glutamatergic, the GABAergic or the FMRP pathways). The tool can help filter the data on various user-defined criteria, such as the quality of the base calling, the type of mutation (synonymous, missense, stopgain…), the inheritance (*de novo*, recessive, dominant), the allele frequency as well as various scores to predict the deleteriousness impact of the variants (CADD, polyphen, SIFT).
Results: We first identified patients carrying a "first hit" affecting a known ASD-risk gene (*SHANK2, SHANK3, NLGN4X, CNTNAP2, CNTNAP4, TBC1D5, KCNB1, HYDIN, MEF2C*) or new compelling candidate genes (*EPHA4, SMG1)*. Using GRAVITY, we could also visualize additional hits in known ASD-risk gene and providing an estimation of the burden of multiple hits for each affected and unaffected individuals.
Conclusions: GRAVITY is a new tool simplifying the discovery of multiple hit in patients, saving a lot of time in the process. Thanks to GRAVITY, we were able to analyse the genetic architecture of 152 individuals revealing new candidate genes and confirming that multiple hits are frequently observed in patients with ASD. Further studies are warranted to ascertain if the burden of multiple hits contribute to the severity of the symptoms in the patients.

166 **108.166** Whole Exome Sequencing of Autism Spectrum Disorder Reveals Novel De Novo Variants in Korean Population

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Background: Â *De novo*genetic variations have been revealed as a risk factor in ASD (Jiang et al., 2013). Whole exome sequencing (WES) techniques provide the opportunity for elucidation of the de novo genetic causes of ASDs.
Objectives: The objective of this family-based whole exome sequencing (WES) is to examine genetic variants of autism spectrum disorder (ASD) in Korean population.
Methods: Â The probands with ASD and their biological parents were recruited in this study. We ascertained diagnosis based on DSM-5^{TM}criteria, using Autism Diagnostic Observation Schedule and Autism Diagnostic Interview – Revised. We selected probands with typical phenotypes of ASD both in social interaction/communication and repetitive behaviour/limited interest domains, with intellectual disability (IQ<70), for attaining homogeneity of the phenotypes. First, we performed WES minimum 50x for 13 probands and high-coverage pooled sequencing for their parents. We performed additional WES for 38 trio families, at least 100x depth. *De novo* mutations were confirmed by Sanger sequencing. All the sequence reads were mapped onto the human reference genome (hg19 without Y chromosome). Bioinformatics analyses were performed by BWA-MEM, Picard, GATK, and snpEff for variant annotation. We selected mutation candidates from probands, which are neither detected in two pooled samples nor both parents.
Results: Fifty one subjects with ASD (5 females, 40~175 months, mean IQ 42) and their families were included in this study. We discovered 109 *de novo* variants from 46 families. Twenty nine variants are expected to be amino acid changing, potentially causing deleterious effects. We assume *CELSR3, MYH1, ATXN1, IDUA, NFKB1, ADCY7* and *DLEC1* may have adverse effect on central nerve system. Additionally *KCNE3*, previously observed in deleterious mutation in periodic paralysis, may be related with ASD.
Conclusions: We observed novel variants which are assumed to contribute to development of ASD with typical phenotypes and low intelligence in WES study.

167 **108.167** Whole Genome Sequencing and Rare Variant Discovery in the Aspire Autism Spectrum Disorder Cohort

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Background:
ASPIRE (Autism SPectrum Interdisciplinary REsearch) cohort is comprised of Individuals that have been diagnosed with ASD (DSM-IV; ADOS-G/ADI-R) and underwent a detailed standardized phenotyping protocol, including morphometrics, through Provincial Medical Genetics Program in BC.
Objectives:
Our goal was to characterize rare genetic variation using whole genome sequencing in a subset of the ASPIRE cohort and to examine genetic findings in the context of patients' deep phenotype data. To achieve this, we assembled a robust bioinformatics pipeline for identification and prioritization of potentially ASD associated variants that incorporates publically available resources and tools as well as in-house developed ones.
Methods:
We obtained whole genome sequences (Illumina paired-end 100 base pair reads, average depth 30x) for each subject. Variants were called using the Genome Analysis Toolkit (GATK) against the human reference genome, and filtered for quality and rarity in population data. To prioritize variants further, we relied on a combination of existing and in-house bioinformatics tools incorporating both gene-level metrics (genic intolerance to mutation, functional effect prediction) and variant level metrics (population frequency, predicted damage). Our efforts included recurating and harmonizing variants reported in the ASD literature, totalling close to 5000 variants from over 2500 ASD individuals. We have made the resulting database available as MARVdb (www.chibi.ubc.ca/marvdb). To collaboratively analyze variants in the context of phenotypes, we used ASPIREdb (aspiredb.chibi.ubc.ca), an interactive web application developed by our lab, which allows researchers to search, organize, analyze and visualize variants and phenotypes associated with a set of human subjects.
Results:
In total 97 high-priority candidate variants were identified, affecting 66 subjects. All of these variants were heterozygous and all but one were autosomal. Of these, 31 were predicted loss-of-function mutations, 3 affecting genes previously associated with ASD and 3 affecting genes associated with other neurodevelopmental disorders. A total of 66 candidate MS mutations were prioritized as potentially pathogenic, including 12 affecting literature-associated ASD genes, and 8 affecting genes associated with other neurodevelopmental disorders. High priority variants were subjected to trio resequencing to assess inheritance.
Conclusions:
Using this approach we have identified, among others, a novel de novo splice site variant in *SCN2A*, predicted to result in a loss of function, in an individual with severe autism and intellectual disability. This finding adds to the evidence that mutations in this gene can be associated with autism without comorbid seizure disorders.

168 **108.168** Whole Genome Sequencing of Extended Families Reveals Novel ASD Risk Variants

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Background: Massively parallel sequencing in autism spectrum disorder (ASD) has focused on whole exome sequencing (WES) and whole genome sequencing (WGS) in trio cohorts for identifying *de novo*protein coding variants. These studies have largely utilized simplex families or siblings with ASD, and a majority of WGS analyses have reported only on protein coding variants.
Objectives: Our study applies WGS to extended, multiplex families with at least two cousins with ASD likely to carry rare, inherited and partially penetrant alterations. We hypothesize that identical by descent (IBD) filtering in these pedigrees would define genomic regions of shared ASD risk and allow for the identification of variants in noncoding regions, coding variants missed by exome sequencing, and structural variants, which could potentially isolate new ASD loci.
Methods: We performed WGS on at least two cousins with ASD across six extended families (15 individuals). Sequencing was performed on the Illumina HiSeq2500 and analyzed through pipelines including BWA-MEM alignment, quality recalibration by GATK, and variant calling with the GATK HaplotypeCaller and FreeBayes. Structural variants (SVs) were called with the SWAN and GenomeSTRiP algorithms. Annotations were applied with ANNOVAR including functional predictions for noncoding variants (CADD, FATHMM-MKL, and Eigen). We determined IBD regions using whole genome genotyping data and the MERLIN package. Variants were prioritized which were shared in all individuals with ASD within each family, rare in the population (<1%), and predicted to have functional significance through *in silico*programs (CADD >10, FATHMM-noncoding >0.5, and Eigen >1).
Results: We sequenced each genome to ~40x coverage and identified >4 million single nucleotide variants (SNVs) and small indels and >100 SVs per individual. Variant calls between HaplotypeCaller and FreeBayes were >95% concordant. IBD filtering in each family limited the total number of SNVs and short indels for analysis to between 732 and 1,020,713, depending on the family's structure. Among coding SNVs, ~94% concordance was found with existing whole exome data (Cukier, et al, 2014); however, WGS identified ~10% more coding variant calls. These include a family with a rare missense mutation in the neurogenesis growth factor *GDF11* and another with a frameshift in the axonal development gene *SLAIN1*. *In silico* prioritization of noncoding regions revealed several variants of interest. For example, two variants were identified in the putative promoter of the chromatin remodeling gene *ARID1B* in one family, and two other variants upstream of ankyrin repeat gene *KANK1* were present in another family. Finally, rare copy number variants were found; one CNV disrupted the promoter of the neurodevelopmental *WWOX* gene and another deleted an exon of the lincRNA *FIRRE*, which is involved in chromosomal organization.
Conclusions: By studying these unique pedigrees, applying cutting edge sequencing and analysis methods, and employing IBD filtering, we establish that WGS of extended families can identify inherited ASD risk alterations. These methods extend the scope of WGS beyond *de novo* protein coding variants to functional noncoding SNVs, SNVs not captured by exome sequencing, and SVs that may contribute to ASD. Taken together, WGS identifies new ASD candidate genes and pathways.

169 **108.169** Sex-Modulated Structural Covariance Networks in Autism

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Background:
Atypical neural connectivity has been proposed as a biomarker for autism, entailing decreased fronto-posterior and enhanced parietal-occipital connectivity, reduced long-range and increased short-range connectivity, and temporal binding deficits. Empirical findings vary substantially depending on the aspects of connectivity examined, the developmental stage of the individual, the spatial and temporal scales, task versus no-task conditions, how motion artefacts are handled, and the specific neural systems of concern. Heterogeneity in connectivity findings is likely further due to key aspects of sample variation, such as sex/gender.
Objectives:
(1) To explore if biological sex moderates the characteristics of structural covariance in autism; (2) To explore the atypical connectivity hypothesis of autism using structural covariance network analysis.
Methods:
Structural covariance of T1 weighted MRI data from 117 individuals in 4 groups (males with autism N=25, neurotypical males N=33, females with autism N=30, neurotypical females N=29), matched for age and IQ. IQ was in the average range or above. Data was analyzed using Freesurfer segmentation for cortical thickness and custom Matlab code to assess graph theoretical and network properties. We specifically investigated metrics describing the relation between cortical thickness and network topology in reference to long versus short-range connectivity. For example, we looked at the relation between anatomical distance and covariance correlation strength and properties of the degree distribution. Statistical significance was assessed using pair-wise Monte-Carlo permutation tests.
Results:
Inter-regional correlation strength as a function of Euclidean distance differed across all 4 groups. Specifically, the female autism group showed a much steeper decline in correlation strength with increased anatomical distance, indicating a balance that more strongly favours local over global connections. In addition, the overall cumulative distribution of the degree of network parcels showed a strong sex difference, with the male control group having a reduced incidence of high degree nodes. This difference was absent in the autism group.
Conclusions:
We report evidence for atypical connectivity in adults with autism compared to neurotypical adults, but the pattern is heterogeneous, both moderated by sex and dependent on the metrics examined. More fine-grained descriptions on patterns of atypical connectivity are needed. These results challenge an over-simplified view that general hypo- or hyper-connectivity marks the atypical neurobiology of autism.

170 **108.170** Cognitive and Head Circumference Differences in 16p11.2 CNV Carriers with and without Autism.

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Background: The phenotypic and etiologic heterogeneity of Autism Spectrum Disorder (ASD) represents a significant hurdle for research. “Genetic-first” studies have allowed focusing on groups of individuals who share the same genetic risk factor for ASD. This condition is multifactorial, and even genetic variants that carry large risk for ASD are not always associated with ASD (eg. 20% of 16p11.2 – 29.6-30.2 Mb-Hg19 – deletion and duplication carriers meet criteria for ASD). The nature of the additional factors present in these individuals with ASD is unknown.
Objectives: The aim of this study is to characterize cognitive dimensions and head circumference (HC) –a proxy for brain size – in carriers of a 16p11.2 copy number variant (CNV) with ASD and those without ASD.
Methods: A total of 265 probands carrying 16p11.2 rearrangements (174 deletion; 91 duplication) and 421 intrafamilial controls recruited from the 16p11.2 European Consortium, the Cardiff University Experiences of Children with Copy Number Variants Study and the Simons Variation in Individuals Project were included in the study. Measures included HC, ADI-R and IQ. We used linear mixed models to compare differences in phenotype between deletion and duplication carriers with and without ASD.
Results: Both the deletion and the duplication are associated with an IQ that is about 25 points lower than familial controls. ASD diagnosis in deletion carriers is associated with a 6.6-point increase in IQ mainly driven by nonverbal skills (p=0.018) and larger HC (+0.78 z-score, p=0.001) compared to deletion carriers without ASD. In contrast, duplication carriers with ASD show an additional decrease of 15 points in IQ (p= 0.002) compared to duplication carriers without ASD. Additional genetic factors underlying the ASD diagnosis in deletion carriers may be inherited since mothers have a significantly higher IQ (8 points; p=0.006) compared to mothers of carriers without ASD. The clinical profile of duplication carriers with ASD also differs significantly from that of deletion carriers with ASD. The former display more repetitive and stereotyped behaviors on the ADI-R (p=0.01).
Conclusions: The clinical differences between CNV carriers with and without ASD may inform on the nature of the additional factors present in the subgroup diagnosed with ASD. In addition, these results highlight the fact that deletion and duplication at the 16p11.2 locus are associated with two distinct underlying mechanisms predisposing to ASD.

171 **108.171** The Effects of 16p11.2 Gene Dosage on Brain Structure

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Background: Copy Number Variants - CNVs are major contributors to neurodevelopmental disorders. Carriers of the deletion or duplication at the 16p11.2 locus (29.6-30.2 Mb-Hg 19) have a 10-fold increased risk of developing autism spectrum disorder (ASD) and present an inverse gene dosage on Body Mass Index and head circumference. Some recent neuroimaging studies have revealed an association between the number of 16p11.2 genomic copies and global brain metrics, as well as regional structural changes in the reward system, language circuitry and social cognition.
Objectives:
Our goals for this study were to 1) Replicate and extend previously published findings on a larger dataset of families with 16p11.2 CNV by pooling new and previously published data; 2) Demonstrate that individuals, who share the same autism risk factor, show robust brain alterations through different cohorts and scanning sites.
Methods: Participants, above 6 years old, were evaluated in the European 16p11.2 consortium and the American Simons VIP study. 361 participants were examined on a 3T whole body MRI scanner on 7 different sites. T1-weighted anatomical images were acquired using a multi-echo magnetization prepared rapid gradient echo sequences (ME-MPRAGE) on 264 participants and a single-echo MPRAGE sequences on 97 participants. Data analyses were performed using the SPM12 and FreeSurfer software packages.
Results: We analyzed MRI data in 78 16p11.2 deletion carriers, 71 duplication carriers, 72 familial controls, as well as 140 extra-familial controls. 11 deletion and 8 duplication carriers met criteria for ASD (13%). Intracranial Volume correlated negatively with the number of genomic copies at the 16p11.2 locus in the European and American cohorts. Both gray and white matter total volumes contributed to this effect. Using Voxel-Based Morphometry in both cohorts, we found a negative relationship between the number of 16p11.2 genomic copies and the volume of bilateral insula, putamen, superior temporal gyri, orbital part of inferior frontal gyri, lingual gyri, and some cerebellar lobules. Both cohorts also presented a positive relationship between the number of genomic copies and the volume of bilateral middle temporal gyri.â€¨We did not find any interaction between the genetic status and the two cohorts, the 7 sites or the gender. Results were also stable across the 7 iterative analyses successively leaving out one of the scanning sites. Subdividing the genetic group in 2 categorical age groups showed the same profile of structural brain abnormalities.
Conclusions: Â These results demonstrate that different ascertainment methods in Europe and the USA led to the same brain differences. The robustness and power of this combined dataset and the relevance of the global and regional findings show that multisite MRI studies are extremely powerful, especially when neurobiological heterogeneity can be reduced by focusing on individuals who share a common ASD risk factor.

Poster Session
109 - Interventions - Non-pharmacologic - Preschool
12:00 PM - 1:40 PM - Golden Gate Ballroom

172 **109.172** A Longitudinal Analysis of Parent Responsiveness Following Intervention

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Background: Replicated findings demonstrate that parent responsiveness (PR) is associated with later child outcomes, and that PR in parents of children at-risk for ASD can be increased by intervention. Further, child behaviors, including sensory hypo-reactivity and social communication, predict later PR, emphasizing the transactional nature of PR. The current study follows up on infants at-risk for ASD participating in an RCT that demonstrated a positive treatment effect on PR at posttest.
Objectives: (1) Determine if there was a continuing treatment effect on PR at preschool follow-up. (2) Examine the longitudinal trajectory of PR by group. (3) Determine if post-test hypo-responsiveness and/or social communication skills predicted PR at follow-up.
Methods: Parents and community-identified infants at-risk for ASD aged 13-15 months (n=87) participated in a RCT of a parent-mediated intervention, Adapted Responsive Teaching (ART). All families received information about community services and monthly monitoring phone calls, while those randomized to ART were coached using a manualized intervention designed to promote using responsive strategies while targeting social communication and sensory regulation. Measures of social communication (Communication & Symbolic Behavior Scales, Social Composite), sensory regulation (hypo-reactivity, measured by the Sensory Experiences Questionnaire and Sensory Processing Assessment), and PR (proportion of 5-second intervals with parent responses, using partial interval coding of 10-minute parent-child videos) were completed at pre- and post-test. When children were 3-5 years old, a subset (n=47) were re-recruited for follow-up assessments, including a third measurement of PR.
Results: Preliminary analyses used coded data from 28 children at follow-up. Although ART parents in the preliminary analyses were not significantly different in PR than comparison group parents at post-test, they reflected the trend of higher PR found in the full sample. At follow-up, however, they were significantly lower in PR than the comparison group, t = -3.02, p < .01 (Figure 1). Posttest social communication, t = -2.24, p = .04, and hypo-reactivity, t = -2.07, p = .05, predicted follow-up PR. Also, an interaction between posttest social communication and group, t = 2.93, p < .01, reflected that higher post-test social communication was associated with lower follow-up parent responsiveness in the comparison group (Figure 2). Overall, findings were significant only in a model incorporating parent report measures of child predictors, but not in a model using observational measures. Models will be examined further with the larger sample when coding is completed.
Conclusions: These preliminary results may be unstable due to the small subsample. We anticipate that full sample results will show that ART group PR was higher than the comparison group at post-test but that this difference was not maintained at follow-up. Reductions in PR in the ART group at follow-up could be concerning, given the theoretical importance of PR for child outcomes. Such a finding may suggest the need to provide ongoing support/coaching to families of children at risk for ASD beyond a 6-month intervention. Possibly strategies parents learned to apply with infants are harder to apply or less developmentally appropriate as children mature and gain new abilities or manifest new symptoms.

173 **109.173** A Meta-Analysis of Pivotal Response Treatment As an Early Naturalistic Developmental Behavior Intervention for Autism

R. M. Klinkel[1] *and G. L. Lyons*[2], *(1)STAR Center for ASD and NDDs, University of California San Francisco, San Francisco, CA, (2)STAR Center, UCSF, San Francisco, CA*

Background: In contrast to Early Intensive Behavioral Intervention (EIBI), there are far fewer systematic reviews and meta-analyses evaluating Naturalistic Developmental Behavioral Interventions (NDBIs), a group of behavioral interventions that (a) share critical treatment components and (b) are often deemed evidence-based (Schreibman et al., 2015). For instance, as an NDBI, stakeholders routinely consider Pivotal Response Treatment (PRT) empirically supported in treating core social-communication deficits; however, the literature lacks sophisticated meta-analytical studies aimed at ascertaining cumulative PRT evidence and effect sizes (ES) across early intervention outcomes. Indeed, stakeholders need clarity regarding PRT's effect on outcomes beyond social-communication. Furthermore, meta-analyses should dually investigate single-case (SCD) and group designs (GD), but researchers typically do not employ the necessary methodology (i.e., hierarchical linear modeling, HLM; Shadish *d*-statistic). Critical to understanding PRT and individualization, such methods also allow for analyses of key moderators (e.g., child characteristics, outcomes, study quality).
Objectives: We answer the following research questions: (a) For both GD and SCD, what are PRT ESs across outcome areas and ES types?; (b) What key variables moderate PRT effects?; (c) What components best constitute PRT?; and (d) What descriptive variables contextualize the findings?
Methods: We systematically selected articles that compared PRT to no-treatment conditions for children with autism under 6 years old; 36 studies (30 SCD, 6 GD) were included. We gathered adequate inter-coder agreement at every stage of search, selection, and variable coding. We coded numerous variables from each study, and extracted SCD data point coordinates and GD statistics. For SCD, we employed HLM, Tau-*U*, and the Shadish *d*-statistic analog of GD standardized mean differences. For GD, we aggregated Cohen's *d*random effects by inverse variances.
Results: Accounting for study quality, we found medium-to-high SCD ESs across social-communication and language, play, and affect outcomes (omnibus HLM ES: γ_{100} Â = 0.87 standardized units, p< .001), with larger estimates for social-communication and language. The GD meta-analysis indicated a moderate-sized effect across outcomes, with larger estimates for measures of communication and language. Observed utterances showed slightly larger comparable effect sizes for SCD versus GD studies. For SCD, higher study quality significantly penalized PRT effects. The HLM analysis of SCD also revealed PRT effects significantly varied between participants. We gleaned inconsistent PRT procedures across studies, but key components (i.e., choice and natural reinforcement) were ubiquitous.
Conclusions: We found early PRT was generally effective across studies and outcomes, evinced by moderate to large ESs. The social-communication and language area, however, generated the largest effect sizes (functional speech, in particular) and greatest confidence (representing 73.6% of the weighted data). PRT produced favorable play and affect outcomes; however, with slightly smaller and/or far fewer effect sizes, claims of positive PRT effects beyond social-communication and language are tenuous. Evidence for PRT's effect on receptive language and cognitive functioning is also weak, while its effects on adaptive behavior is emerging – making it difficult to draw comparisons with EIBI meta-analyses, or understand PRT as a comprehensive early intervention. Based on our findings, we outline a model for advancing PRT and NDBI research.

174 **109.174** AAC: Attention, Exploration and Response in Children with Autism

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Background: Augmentative and Alternative Communication (AAC) is a commonly prescribed intervention for pre- and minimally- verbal children with Autism Spectrum Disorder (ASD). Despite widespread use and emerging evidence for its effectiveness, little research exists examining the mechanisms underpinning individual differences in response to AAC intervention. Variability in outcomes may be related to the complex social-communication needs of the children, given that AAC is generally prescribed to those with the most significant needs. However, differences in response to this intervention may also partly be related to visual attention to, and propensity to spontaneously engage with the AAC system.
Objectives: The aims of this study were to look at the relationship between (a) visual attention to, and (b) physical exploration of, a picture-based AAC system upon first exposure, and subsequent response to instructions provided by a teacher using a picture-based AAC system in a simulated activity.
Methods: Participants were children with a diagnosis of ASD between the ages of two and five years at intake to a community-based early intervention program. The extent to which children visually attended to and physically explored AAC was gathered from a free play activity, during which children were given the opportunity to interact with a picture-based AAC system for 1 minute. Five second interval coding was used to code for the presence/absence of these behaviours. Children's responses to the picture-based AAC system were determined by their ability to carry out a set of 8 instructions delivered to them using AAC in a simulated teaching activity (e.g., "I want you to pick up the [object] and put it in the [container]"). Children received 1 point for collecting the correct item and attempting to insert it in the correct container, for a maximum of 8 points.
Results: The participants in this study visually attended to, and physically explored, the AAC system during an average of 79.39% (SD 27.33%, range 8% to 100%) and 79.38% (SD 23.78%, range 25% to 100%) of intervals, respectively. Average performance score (i.e., ability to follow instructions delivered using AAC) was 2 (25%; SD 3.01, range 0 to 8), with only two children (14.3%) achieving the highest possible score of 8. Using Spearman's correlation coefficient, we found no relationship (r = -.030, p = .918) between visual attention to AAC during free play and subsequent performance, and no relationship (r = .066, p = .822) between physical exploration of AAC and subsequent performance.
Conclusions: Preliminary findings suggest no link between visual attention to, and exploration of, AAC, and subsequent task performance on first exposure to the system. It remains to be tested whether initial response to AAC is associated with response to interventions in which AAC is either a primary or central component in the longer term.

175 **109.175** An Analysis of Changes in Child Behavior during Esdm Parent Coaching

M. L. Rocha[1]*, A. C. Stahmer*[1]*, D. K. Cain*[2]*, L. A. Vismara*[3]*, G. Dawson*[4] *and S. J. Rogers*[1]*, (1)Psychiatry and Behavioral Sciences, UC Davis MIND Institute, Sacramento, CA, (2)Human Ecology, UC Davis MIND Institute, Davis, CA, (3)York University, Sacramento, CA, (4)Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC*

Background: Children with ASD or ASD risk under the age of 3 are eligible for public early intervention services and for those who live in low resource communities, these are often their only services. Providers from those settings typically use parent coaching to serve a wide range of young children with developmental problems and may have little knowledge of the specific intervention needs of toddlers with ASD. The Early Start Denver Model (ESDM) is an evidence-based practice developed specifically for toddlers with or at risk for ASD. ESDM is appropriate for public early intervention services because of its combination of developmental and behavioral strategies, its defined and manualized developmental curriculum and teaching practices, its interdisciplinary orientation, and its family-centered focus. However, the impact that each ESDM Parent Coaching strategy has on child behavior is unknown. Helping providers and families in low resource areas to adapt Community ESDM requires us to determine the most important strategies of ESDM Parent Coaching as the first step toward adapting ESDM for very young children and families living in rural or low income, and highly diverse settings.
Objectives: This study assessed the effect of four different ESDM Parent Coaching topics on target child behaviors. In addition, we assessed the impact of the order in which the strategies are taught.
Methods: Four children with ASD, ages 17-27 months old, and their parents participated in a single subject multiple baseline component analysis design across subjects. Each child and family received parent coaching sessions in the clinic 3 times per week for 4 weeks. Ten-minute video recordings of parent-child dyad interactions during baseline and treatment sessions were coded for child behaviors.
Results: Preliminary data from the first two participants suggest differential changes in child behavior based on strategies parents learned during sessions. Increases in sensory social play were seen for the first time when parents learned 4 step joint activity routines and these increases persisted through the rest of the treatment. Parent learning to (1) balance social communication exchanges (nonverbal communication; developmentally appropriate language; narrating and pointing) and (2) gain child attention were associated with greater instances of children imitating object related actions. Object toy play increased throughout all conditions regardless of component order. Additional patterns and order effects will be examined once the remainder of the data is coded.
Conclusions: Results will be discussed in terms of the active ingredients of ESDM and the implications of this data for adapting ESDM for diverse early intervention service systems.

176 **109.176** An Examination of the Social Validity of Jumpstart, an Education and Training Program for Parents of Children with Autism Spectrum Disorder

J. A. Muhlenkamp[1], *K. Hale*[1], *R. Tewksbury*[1], *S. Zwicker*[1], *A. Gonzales*[1], *B. C. Orr*[2], *B. Harris*[1], *N. L. Matthews*[3] *and C. J. Smith*[3], *(1)Southwest Autism Research and Resource Center, Phoenix, AZ, (2)Southwest Autism Research & Resource Center (SARRC), Phoenix, AZ, (3)Southwest Autism Research & Resource Center, Phoenix, AZ*

Background: Â JumpStart is a short-term education program for parents of children with autism spectrum disorder (ASD). Previous research has documented objective parent and child outcomes, including increased parent knowledge, parent fidelity of implementation of pivotal response treatment (PRT), child responsivity, and reduced child aberrant behavior (Matthews et al., under review). Social validity of the program remains unexamined.
Objectives: Â To examine social validity of JumpStart by comparing changes in parent perceptions of their own knowledge between treatment and delayed treatment control (DTC) groups.
Methods: Â Participants were 25 parents of children recruited from the JumpStart waitlist who were enrolled in the treatment (n = 12; 0 fathers; child M_{age} = 37.92 months, SD = 9.34) or DTC (n = 13; 1 father; child M_{age} = 40.00 months, SD = 12.54) group. Children had an ASD diagnosis (n = 21) or an 'at-risk for autism' (n = 4) classification.
JumpStart meets twice weekly over a 4-week period (weeks 2-5). At a study visit 6 weeks prior to the program (DTC group only), orientation (week 1), and a 1-week follow-up (week 6), parents completed a 17-item questionnaire (Table 1) that asked parents to rate their perceived knowledge of topics covered during JumpStart using a Likert scale ranging from "strongly disagree" (1) to "strongly agree" (7).
Results:
Descriptive statistics are reported in Table 1. Separate 2 (group) x 2 (time point) ANOVAs were conducted (adjusted alpha of .002 used to account for multiple comparisons). There were significant group by time interactions on items assessing parents perceived knowledge of ASD (p < .001), applied behavior analysis (p < .001), PRT (p < .001), and perceived ability to implement PRT (p < .001) and respond appropriately to their child's disruptive behaviors (p = .002). On all items, the treatment group demonstrated larger gains than the DTC group. Following a similar pattern, but only approaching statistical significance, were parents' perceived ability to prevent disruptive behaviors (p = .04), knowledge of autism-related services funded by the state (p = .01), understanding of services covered by health insurance (p = .09), understanding of parents' roles in creating and revising IEPs (p = .02), ability to arrange an appropriate educational placement (p = .004) and special education services (p = .004), and ability to toilet train their child (p = .03).
Conclusions: Â Arguably as important as objective outcomes are parent perceptions of the knowledge and skills gained during JumpStart. Parents in the treatment group reported gains compared to the DTC group on a number of topics. Perhaps most important to consider are the items on which groups did not demonstrate differences, suggesting that parents who complete JumpStart are not perceiving increased knowledge in these areas compared to controls. The treatment group did not differ from the DTC group in changes in perceived understanding of the causes of their child's behavior, understanding of the Arizona Long Term Care System, ability to obtain appropriate state-funded services, and understanding of/satisfaction with their child's IEP. Implications of these findings and future directions will be discussed.

177 **109.177** Autism Spectrum Disorder and Early Intervention Services in New Jersey from 2006-2012

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Background:
Over the past decade Autism Spectrum Disorder (ASD) has increased significantly. One general consensus among all stakeholders is that ASD should be identified early which can allow for benefits of early intervention. Through early intervention, children make gains in cognitive ability, social functioning and even changes in core symptom severity.
Objectives:
The purpose of this study was to describe EI utilization by ASD children in NJ over time and to identify sex, race, ethnicity and SES-based disparities in EI utilization.
Methods:
Data were collected as part of the New Jersey Autism Study (NJAS), an ASD surveillance investigation carried out in Essex, Union, Hudson and Ocean counties. Using an active case-finding method established by the Centers for Disease Control and Prevention (CDC), case-specific data were developed for children who were born in 1998, 2002, and 2004 and resided in the surveillance region during Study Years (SY) 2006, 2010, and 2012 respectively. NJAS data were based on review, analysis and independent ASD case- determination derived from information contained in health and education records. Demographic and case-specific information reflecting and case-specific interventions, including receipt of EI Services, were analyzed. The socioeconomic status (SES) of children with ASD was represented by the District Factor Group (DFG) ranking, a community-level index.Â Statistical analysis was performed using chi-square tests.
Results:
Information from 2,029 8-year-old ASD-confirmed children identified from three cycles of ASD surveillance in New Jersey between 2006-2012 (SY2006: 533; SY2010: 696; SY2012: 800) was analyzed to determine differences by group, over time. Increasing proportions of ASD children received EI services during the period (EIP – SY2006: 39%; SY2010: 43%; SY2012: 50%) (p<.001). Boys and girls with ASD were equally likely to receive EI services and both males and females enjoyed increased levels of EI participation in the period (Girls - SY2006: 36% and SY2012: 52% (p<.01); Boys – SY2006: 40% and SY2012: 50% (p<.01)). We observed declining race and ethnicity-based disparities, most notably among Hispanic children, 17% increase from 2006 to 2012, from 28% in 2006 to 45% in 2012 (p<.05). SES was associated with greater EI participation in each cycle and increased significantly, across all levels. However, In 2006, 34% of children with ASD from Low SES areas and 36% of children from Mid SES areas were receiving EI services compared to 49% from High SES areas (p<.01). By 2012, there was still a SES disparity where 44% of Low SES children were receiving EI services compared to 50% of children from Mid SES, and 63% of children from High SES areas (p<.001).
Conclusions:
As of 2012, the most recently-completed cycle of ASD monitoring in NJ, half of ASD children received EI services. EI participation increased significantly (11%) between 2006 and 2012.Â Some disparities may be declining, while SES-based differences are prominent. Improved strategies are necessary to decrease disparities in receipt of Early Intervention services.

178 **109.178** Characterizing Children with Autism Spectrum Disorder (ASD) Who Respond to a Gluten-Free Casein-Free (GFCF) Diet

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Background: The Gluten-Free Casein-Free (GFCF) diet continues to be one of the most commonly used complementary and alternative treatments in children with Autism Spectrum Disorders (ASD). However, the current state of science on the GFCF diet is mixed with some studies showing the diet may improve ASD symptoms in some children, while other studies have found no effects from the diet. Similarly, several healthcare providers and parents of children with ASD adamantly report some children to have noticeable positive effects from the GFCF diet. Given these mixed findings, evidence is mounting to indicate that a subgroup of children with ASD may exist, which could potentially explain the mixed effects of the GFCF diet. Yet, to date, there has been no attempt to identify this subgroup of children with ASD and the characteristics they possess.
Objectives: To identify children with ASD documented as responding to the GFCF diet and characterize them based on clinical presentations, laboratory findings, and medical histories.
Methods: A retrospective chart review was conducted at a pediatric primary care clinic to examine medical records of children with ASD on a GFCF diet (2005-2015). IRB approval was obtained. Data collected from the medical records were inputted into the statistical software program SPSS. Statistical analysis evaluated the differences between GFCF diet responders and non-responders using a chi-square and Wilcoxon rank sum test.
Results: A total of 33 participants (n=33) were included in this study. The sample included 26 males and seven females. The age of participants ranged from 1.5-16 years (mean=5.07 years, SD=4.04). A total of 1,195 variables were collected from 33 participants. Twenty-two participants (n=22) were identified as responders to the GFCF diet and 11 participants (n=11) were identified as non-responders. Three types of ASD were identified: regressive after 12-months-old (n=13), non-regressive (n=18), and failed to progress after 12-months-old (n=2). A chi-square determined a significant difference existed in GFCF diet response and type of ASD (p=.026), plasma amino acid 3-methylhistidine (p=.013), and plasma amino acid alanine (p=.034). A Wilcoxon rank sum found significant differences between GFCF non-responders and responders in urine octenedioic (p=.006), fecal SIgA (p=.006), urine 3-hydroxyglutaric (p=.007), plasma amino acid glycine (p=.019), plasma amino acid alanine (p=.037), and serum alkaline phosphatase (p=.044).
Conclusions: Findings from this study indicate statistically significant differences in stool, plasma, and urine variables between children with ASD who responded to a GFCF diet and those who did not. These findings lend preliminary support for the clinical accounts of some children with ASD responding more favorably to a GFCF diet than others. It is expected that characterizing known responders to the GFCF diet will provide critical information to assist in clinical decision making, as well as help develop inclusion/exclusion criteria necessary for future clinical trials. Additionally, findings from this study revealed unexpected similarities among laboratory markers of all participants. Findings are expected to not only contribute to what is currently known, but also generate future research on biomarkers, microbiome, and characterization of all children with ASD.

179 **109.179** Evaluation of the Autism Distance Education Parent Training (ADEPT) Program in Boise, Idaho

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Background:
Autism Spectrum Disorder (ASD) symptoms are optimally mitigated when treatment is started as early as possible (Zweigenbaum, et al., 2015). An effective intervention for young children with ASD is Applied Behavioral Analysis (ABA) (Rogers and Vismara, 2008).
In Idaho, access to ABA treatment is lacking. A semblance of ABA is provided by developmental disability agencies to children who qualify. Generally, those providing the treatment obtain less training and supervision in ABA compared to behavior therapists in other states. Also, the quality and type of behavioral intervention offered by school districts is variable.
Professionals at the MIND Institute at UC Davis have addressed ABA access issues by designing the Autism Distance Education Parent Training (ADEPT) program for parents who have a child with an ASD. Parents review on-line modules that demonstrate how to use ABA principles to improve functional skills and reduce problematic behaviors in children with ASD. Parents then attend two, twelve hour, group parent training workshops led by treatment professionals to enhance their ABA knowledge. Parents then have a home visit with two of the treatment professionals after each workshop. Findings from an unpublished pilot study at MIND found a significant increase from pre to post training in parent-reported confidence in the ability to implement ABA principles and parent knowledge of ABA principles.
Objectives:
Providers at a children's hospital in Boise, Idaho wanted to determine the benefit of the ADEPT program for local parents of children with ASD.Â Specifically, would parent-reported confidence in the ability to implement ABA principles and parent knowledge of ABA principles increase from pre to post training? Also, would parenting sense of competence increase and autism-related parenting stress decrease from pre to post training? Positive outcomes would support funding for broader investigation and implementation of the ADEPT program throughout the state.
Methods:
Five providers from the children's hospital (mental health providers and an occupational therapist) were trained by a trainer from UC Davis MIND Institute on how to conduct the ADEPT training. Simultaneously, eight parents who had a child with an ASD (ages 2 to 5) underwent the ADEPT training, which was led mainly by the providers. Parents of children with a recent diagnosis of ASD were recruited to participate from a referral pool created by the providers.
Before and after training, parents completed the Autism Parenting Stress Index (Silva and Schalock, 2012), Parenting Sense of Competence Scale (Johnson and Mash, 1989), and surveys that assessed parent-reported confidence in the ability to implement ABA principles and parent knowledge of ABA principles (unpublished).
Results:
Parent-reported confidence in the ability to implement ABA principles increased from pre to post training. Parent knowledge of ABA principles either remained the same or impoved from pre to post training. Parenting sense of competence and autism-related parenting stress did not change from pre to post training.
Conclusions:
Initial results are promising and are generally consistent with the MIND Institute pilot study. Future studies will examine the benefit of the ADEPT training across Idaho.

180 **109.180** Examining Fidelity of Implementation in a Naturalistic Developmental Behavioral Intervention in Community Settings: The Influence of Provider Characteristics

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Background: Research supports the critical need for early intervention to improve outcomes for young children at risk for autism spectrum disorder (ASD). Parent-mediated naturalistic developmental behavioral early interventions (NDBI) have demonstrated positive family outcomes and offer the potential for increased intervention intensity (Burrell & Borrego, 2012). However, there has been little dissemination of parent-mediated NDBI into community settings. Community providers with expertise in both implementation of NDBI strategies and parent coaching are needed to effectively deliver NDBIs. However, based on the multiple avenues through which children with ASD may receive services, community providers have a range of educational backgrounds and ASD specific experience. As communities struggle to effectively serve the growing number of toddlers at risk for ASD, more information is needed on provider characteristics that may influence the appropriate use of NDBIs in community settings.
Objectives: This study provides a preliminary examination of provider characteristics as potential moderators of providers' fidelity of implementation of an evidenced-based parent mediated NDBI for toddlers at risk for ASD (Project ImPACT for Toddlers or PI for T; Ingersoll & Dvortscak, 2010).
Methods: Â Participants include 33 early intervention providers with varied training backgrounds, specializations and education levels working in a range of community-based settings. Participants received 12 weeks of training in PI for T from a leader within their agency who was trained by the research team. Video observations of providers utilizing intervention strategies with families were collected before, during, and after training. Observations were behaviorally scored for intervention fidelity of implementation (FI). Coders rated each intervention component on a 5-point scale (1=did not use; 5 = used throughout). FI scores were compared at baseline, post-training, and after three months of use. Provider characteristics (e.g. education, discipline, experience) and setting variables were examined as potential moderators of FI.
Results: Â Preliminary results suggest that while many providers do not meet FI overall after training, they demonstrate improvement over time in some domains, including allowing the child to choose the activity, modeling developmentally appropriate communication and play, and expanding/adding complexity to the child's responses. Preliminary analyses show no difference in FI based on education level. Providers' years experience in early intervention demonstrate a relationship with appropriate use of prompting strategies, such that providers with moderate experience demonstrate highest fidelity. Additionally, providers with 20+ years of experience in either early intervention broadly or ASD specifically haveÂ lower FI scores in some domains. Further moderators, including intervention setting, will be analyzed to identify any additional impacts on fidelity.
Conclusions:
Identifying relationships between provider characteristics and FI of parent-mediated NDBIs can support improved dissemination of these evidence-based strategies in community settings. Providers who have been in the field longer may need individualized training on how to shift their current practice to best align with an evidence-based approach. Future research should continue to address the fit between community providers and the use of evidence based practices.

181 **109.181** Exportable Communication Intervention for Classroom Staff Serving Children with Autism Spectrum Disorder: Towards Improving the Feasibility of Evidence-Based Practices in Community Settings

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Background:
Naturalistic Developmental Behavioral Intervention (NDBI) is an intervention model for young children with autism based on behavioral and developmental principles, naturally occurring contexts and contingencies, and shared control between the interventionist and student. Recent studies have found empirical support for NDBI in controlled research trials. Further, a number of studies have replicated findings in community preschool settings with some degree of success. However, reported roadblocks to community implementation include teacher's lack of time to add new components to their preschool day, insufficient staffing numbers to work in one-on-one settings with children, and difficulty understanding and applying the less structured techniques that characterize NDBI, (as opposed to more manualized behavioral practices). A further complication for community-based intervention studies is that implementation data for intervention in preschool classes is often under-reported and challenging to collect.
Objectives:
1. Develop an NDBI program that maximizes feasibility, acceptability and implementation fidelity for stakeholders.
To meet this objective, NDBI principles were mapped onto four existing classroom routines (e.g. snack, outdoor/gross motor time, story time and free play) resulting in the development of four curricula. This was done to improve the fit of NDBI principles to preschool contexts and promote implementation fidelity.Â Additionally, intervention activities and coaching sessions took place within an integrated classroom environment, and did not rely on "pull out time" for students in order to maximize feasibility and sustainability.
2. Promote positive changes in target children's social communication as measured by both quantity and quality of communication bids.
Â To meet this objective, consent for video-taped data was obtained from the majority of students in classrooms, allowing for outcome data to be analyzed in natural preschool contexts from video-recorded samples of whole class activities.
Methods:
This multiple-baseline design study piloted a social communication intervention using NDBI principles with four teacher/target child dyads in the Early Childhood Education Center at the Nisonger Center. After two to six weeks of baseline data collection, participating classroom staff members received eight weeks of intervention. Active intervention consisted of four didactic training sessions and seven live-coaching sessions. Implementation fidelity data and communication outcomes were video-recorded and coded by blinded research assistants.
Results:
Regarding outcomes, the present study examined 1) teacher fidelity to intervention practices in pre-identified classroom contexts 2) child outcomes in terms of communication targets and classroom engagement 3) stakeholder ratings of feasibility/acceptability and effectiveness.
Preliminary findings indicate that classroom staff are able to implement NDBI techniques at high levels of fidelity within classroom contexts (no "pull out" time required), report that the intervention is feasible, and that target children have increased communication bids as a result of intervention.
Conclusions:
Integration within whole class activities, as well as presenting strategies in a clearly delineated, exportable fashion while keeping intervention intensity minimal may have been key to high teacher fidelity, high ratings of feasibility, and in turn, increased communication on the part of target children. Future research and clinical intervention efforts should focus on considering the match between intervention strategies, their presentation, and integration into natural contexts.

182 **109.182** Home-Based Play Routines in Low-Resourced Families of Young Children with ASD: Parent Strategy Implementation

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Background:
In recent years, there has been much discussion about bridging the research-to-practice gap in autism research. Dingfelder and Mandell (2011) propose that one of the best ways to examine whether interventions are effective is to examine how the intervention is implemented in real-life context. This is particularly critical for families who have limited access to resources. Many autism interventions with parent training components have demonstrated effectiveness in increasing child outcomes but rarely are data reported on parent implementation in contexts outside the training sessions (Green et al., 2010; Landa, Holman, O'Neill, & Stuart, 2012).
Objectives:
The current study will examine 1) group differences in caregivers' generalized implementation of intervention strategies, and 2) change scores in strategy implementation within the caregiver mediated intervention group.
Methods:
Participants were 28 dyads of caregivers and young children with autism spectrum disorder (ASD), ages 2-5. The sample is a subset of a larger RCT that examined children's social communication skills in a naturalistic developmental behavioral intervention (NDBI) targeting joint engagement, play, and joint attention (Kasari et al., 2014). Caregivers were randomized to receive either 3 months of group caregiver education (CEM) or individualized caregiver-mediated intervention (CMM).
The *Mullen Scales of Early Learning* (MSEL; Mullen, 1989) was used to determine children's cognitive ability. The Mullen yields age-equivalent scores for visual reception, fine motor, receptive and expressive language skills.
Home Observation. The home observation is a 30-minute videotaped session that records everyday home routines, including play, that the child and his/ her caregiver spent time doing together without the presence of the interventionist. These home observations are videotaped by research assistant blind to treatment condition. Parent strategy implementation was coded during the 30-minute taping, specifically during play interactions. Strategies coded include: Basic strategies, Setting up the Environment, Following the Child's Lead, Play Routines, Expanding Routines, Joint Attention, and Language.
Results:
Linear mixed models were used to model the change in strategies from baseline to exit. Caregivers in the CMM group improved significantly more in all strategies except for play routines compared the CEM group from baseline to exit (Basic Strategies: $F(1,24)=11.23$, $p=0.003$, Setting up the Environment: $F(1,24)=21.50$, $p<0.001$, Following the Child's Lead: $F(1,24)=29.07$, $p<0.001$, Play Routines: $F(1,24)=3.42$, $p=0.077$, Expanding Routines: $F(1,24)=6.25$, $p=0.02$, Joint Attention: $F(1,24)=14.33$, $p<0.001$, LanguageÂ $F(1,24)=21.44$, $p<0.001$ and overall strategies: $F(1,24)=45.66$, $p<0.001$). On average, the CMM group increased 40.2% in their overall strategy implementation at exit (fidelity score: 70.2%) compared to the CEM group who stayed relatively the same from entry to exit (fidelity score at exit: 33.4%).
Conclusions:
This study demonstrates generalization from training sessions with parents to naturalistic demonstration of skills when videotaped by a blinded videographer in their home. The two strategies that caregivers improved the most suggests that by end of treatment, they were allowing their children to initiate more and were also becoming more aware and responsive to their children's communication. Future parent-mediated interventions should continue to focus on child outcomes, but also include parent fidelity implementation measures to assess the adoption, feasibility, and maintenance of these intervention strategies.

183 **109.183** Imitation in Improvisational Music Therapy Supports Engagement in Children Autism Spectrum Disorder

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Background:
Imitation plays a crucial role in learning to communicate, and allows individuals to engage in reciprocal communication. Previous research by has suggested that exact imitation is more effective than contingent responding at improving social interaction in children with autism. In addition, many naturalistic treatments for autism include an imitation phase at the beginning of the treatment to foster engagement and joint attention. For some treatments, the imitation is exact while others have suggested that elaborative imitation can serve both to build rapport with the child as well as provide a means of social-interaction. This study is the first study to test the specific technique of imitation in improvised music therapy (IMT) and is the first to test the relative effectiveness of exact imitation versus elaborative imitation, and contingent responding.
Objectives:
This study tests the relative effectiveness of three treatment strategies used during IMT for children on the autism spectrum.
Â Methods:
7 preschoolers with autism participated in the study. A single-subject multiple treatment design tested the relative effectiveness of three IMT treatment techniques: 1) exact imitation (ExI) in which the therapist imitated the rhythm or melody of each child's turn, 2) imitation with elaboration (IE) in which the therapist first imitated the child directly and then added to or elaborated on the child's turn, and 3) contingent response/accompaniment (CRA) in which the therapist played music to match the tempo, intensity, or mood of the child's turn. Children participated in three 30-minute therapy sessions of each condition. The order of conditions was randomized for each participant. Sessions were videotaped and later coded for treatment fidelity of each of the therapist's turns. Relative effectiveness of the treatments was assessed by measuring child engagement behaviors using the 5 non-symbol infused engagement states from Adamson et al.'s (2000) engagement scale.
Â Results:
The results suggest that ExI (.22) and IE (.23) resulted in the highest median rates of positive engagement behaviors, and the lowest median rates (.06 and .09 respectively) of unengaged behaviors. CRA resulted in the lowest median rate of engaged behaviors (.14) and highest median rate of unengaged behaviors (.11).Â Scrutiny of individual participant's scores, however, suggests that certain treatment conditions are better at encouraging certain types of engagement. EI almost uniformly (6/7 participants) resulted in the worst coordinated joint attention while CRA resulted in the best coordinated joint attention in 5 out of 7 participants. Supported joint attention, on the other hand, was best in the EI.
Â Conclusions:
This the first study to compare the effectiveness of individual treatment strategies used in IMT. The results suggest that techniques that involve imitation (either exact or elaborated) may be best at encouraging positive engagement states in children on the autism spectrum during improvised music therapy. We note that as a single-subject study, this is only a first foray into the topic and further work needs to be done with a more rigorous experimental design.

184 **109.184** Impact of Early Childhood Intervention Programme (Developmental Journal VI) on Behaviour Difficulties in 3 Year Old Children with Severe Visual Impairment 'at High Risk' for ASD

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Background:
Congenital visual impairment (VI) is associated with social communication difficulties and a high risk of later diagnosis of autism (11-40%)(Brown et al, 1997; Mukkades *et al.,* 2007). A first national UK prospective longitudinal cohort study of infants with congenital disorders of the peripheral visual system (CDPVS) and profound-severe VI has been investigating the antecedents, pathogenesis of and impact of early intervention on developmental and social communication outcomes at 3 years in this vulnerable clinical population (Dale et al) The Developmental Journal for Young children with VI (DJ) (Dale and Salt 2008),designed specifically for children with VI, is a parent-delivered early intervention supported by practitioners, with specific guidance to facilitate parent child interactions and strategies in the context of individualised developmental goals including social. The materials are derived from extended clinical and research work of the Developmental Vision team (Great Ormond Street Hospital).
Objectives:
This part of the study investigates the impact of early community based intervention (DJ) vs other community support (CS) on early behaviour difficulties and 'pervasive developmental difficulties' (CBCL) which have been shown to be early risk signs for ASD in children with VI (Absoud et al 2011).
Methods:
This analysis included the subgroup of children with 'potentially simple' CDPVS and severe VI (N=22). Children with 'complex' disorders and profound VI were not included (N=14). Practitioners particularly specialist teachers for VI reported through visitation logs on the type of intervention they used with the child over a 12 month period (DJ:N = 9; CS:N = 13). At 3 years of age (M=38.73 months; SD=2.88), children's nonverbal cognition (Sensorimotor Understanding-SMU) was assessed using the Reynell-Zinkin Scales for Children with VI and parents completed the Child Behavior Checklist (CBCL).
Results:
Non-parametric Mann-Whitney U analyses with intervention type (DJ vs CS) as a grouping variable and the T-scores from 3 subscales of the CBCL as outcome variables (Withdrawn, Pervasive Developmental Problems (PDP), Internalizing composite) revealed differences between the two groups. Children receiving the DJ intervention were reported to have lower Withdrawn problems (M=51.89 SD=3.21) compared to children receiving the CS intervention (M=58.31 SD=7.66; p<.05), with an effect size of 0.52. Similarly, there were trends in the same direction for PDP, (DJ: M=53.56 SD=5.22; CS: M=58.54 SD=8.32;p=.07) and Internalizing composite, (DJ: M=43.56 SD=10.06; CS: M=51.85 SD=9.55; p=.08). The children's cognitive level (SMU) was not significantly different across the two types of intervention (DJ: M=119.45 SD=7.73; CS: M=112.74 SD=34.15; p=.79).
Conclusions:
For the first time early childhood intervention with a VI-specific parent mediated developmental programme between 1 to 2 years has shown positive impact in reducing behaviour difficulties in 3 year olds with congenital severe VI. Community delivery of the Developmental Journal appears to provide supports to parents which help mitigate the tendency of children with VI to withdraw and become more socially disengaged in the early years. The evidence will be considered further in the context of other parent-practitioner factors such as quality of relationship and frequency of home visiting and other child associations.

185 **109.185** Intervention in the Community for Toddlers with ASD: Paraprofessionals' Ratings of Implementation Complexity and the Association with Observed Intervention Implementation

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Background: Treatment fidelity is a concern across intervention studies for children with autism both in clinic and when transferring practices into the community (Dingfelder and Mandell, 2011). To enhance researchers' ability to support community implementation, it is necessary to better understand factors that may influence intervention fidelity. The present examination looks at paraprofessionals teaching assistants (TAs) observed implementation scores and their self-report of perceived complexity to deliver the intervention including effort, experience, as well as comfort and confidence in implementing the intervention.
Objectives: To determine whether there is an association between TAs' intervention implementation fidelity and their self-reports of the perceived complexity of the intervention.
Methods: The analysis includes 43 children who were randomized to receive the JASPER intervention (Kasari et al, 2006; 2008) as part of a larger intervention trial. Eighteen TAs delivered the JASPER intervention. On average TAs were 30.25 years old and worked at the center for 2.27 years. All but one of the TAs were ethnic minorities. Ten-minute TA-child play interactions were videotaped at treatment exit and coded for strategy use (implementation). Implementation codes include subscale scores (i.e., basic strategies, setting up the environment, following the child's lead, play routines, joint attention/requesting skills, and language). TA Diaries (adapted from Kasari et al., 2003) were completed at study entry. TAs rated 6 questions using a 1-5 scale (1=strongly disagree, 5=strongly agree) to represent their experience in implementation (e.g., strategies feel new/complicated, goes beyond their comfort zone, requires extra work/time). These items were summed to report total perceived complexity, the degree to which TAs felt the intervention was challenging to implement.
Results: Average total diary scores were 17.07 (SD=4.31) out of a total possible score of 30. A Pearson bivariate correlation coefficient was computed to determine the association between implementation and complexity rating scores. There was a positive correlation between the fidelity subscale of following the child's lead and total perceived complexity rating (r= 0.333, n= 43, p=0.029). There were also a positive correlation between the fidelity subscale of setting up the environment and total difficulty score (r=0.354, n=43, p=0.020). TAs' average implementation of setting up the environment in the sample was 90.02% (SD=10.78%), and average implementation of following the child's lead was 85.72% (SD=11.31%).
Conclusions: TAs' initial perception of implementation complexity may be linked to higher quality intervention implementation in the particular areas of setting up the environment and following the child's lead. In this intervention, these strategies are foundational, providing a framework to layer on more strategies and learning opportunities. Awareness of the time and work required to implement unfamiliar environment and following strategies is correlated with implementing these strategies more effectively. It is possible that focusing more on the complexities and newness of an intervention translates to better foundational practices because these strategies are the first thing that the TAs do in implementation before incorporating higher level strategies.

186 **109.186** Meta-Analysis on Technology-Based Versus Non-Technology Based Social Communication Interventions for Children with ASD

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Background:
Educators and clinicians now have access to a growing number of technologies that they can incorporate into their interventions with children with ASD. Captivating sound and visual effects, as well as consistency in target demonstrations are amongst the reasons that support the use of technology in intervention (Moore & Calvert, 2000; Bernard-Opitz, Sriram, Nakhoda-Sapuan, 2001). Meta-analysis studies that explored the benefits of technology-based social-communication interventions yielded mixed findings. One meta-analysis (Grynszpan, Weiss, Perez-Diaz, & Gal, 2014) demonstrated a positive effect with the use of technology in therapy, whereas another meta-analysis (Wang & Parrila, 2011) found no evidence to support the use of technology. Existing meta-analyses either concentrated on studies that compared children receiving technology-based therapy to a waitlist/typically developing group, or on single-subject intervention studies where a comparison group was lacking. A meta-analysis conducted on studies that included children with ASD in both a technology-based intervention group and a non-technology intervention control group would improve clinical decision-making regarding therapy delivery method.
Objectives:
To compare the effectiveness of technology-based versus non-technology based social communication interventions for children with ASD using a meta-analysis approach.
Methods:
A systematic literature search was performed using keywords including "autism," "ASD," "technology," "computer," "robot," "video," and "virtual." A total of 5386 studies were identified. 24 studies met the inclusion criteria: a) included at least one participant with diagnosis of ASD; b) employed randomized control trial or alternating treatment designs; c) contain at least one dependent measure of social communication (verbalizations, affect, imitation, joint attention, turn-taking, requesting, pointing, or social interaction). 12 studies did not report Ms or SDs and thus were excluded from further analysis. A total of 12 studies containing 89 participants with ASD were included in the analysis. Across all studies, we extracted 37 dependent measures that were related to social communication. For each dependent measure, we calculated the standardised mean difference (SMD) between the technology-based intervention and non-technology based intervention groups. Then, a Z-test determined whether the SMDs across studies were reliably different from zero.
Results:
Overall, interventions conducted through technology did not result in better social communication outcomes compared to those conducted without technology (Cohen's d = 0.14; standard error =0.68, p=0.17).
Conclusions:
Based on studies with the most stringent methodological designs, our meta-analysis found that children with ASD did not benefit more from technology-based intervention compared to non-technology based intervention. Studies (e.g. Bernard-Opitz et al., 2001) have suggested that technology-based interventions can result in more long-term improvements of skills in children with ASD. Future studies on this topic should consider both immediate intervention outcomes and the generalizability and sustainability of newly learnt skills.

187 **109.187** Occupational Performance Coaching Via Telehealth: A 12-Week Intervention for Families of Children with Autism Spectrum Disorders

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Background: Underserved families of children with ASD often have difficulty accessing services, which may negatively impact family and child health. Telehealth has been shown as a promising way to deliver services to an increased number of underserved families (Vismara, Young & Rogers, 2012). When professionals partner with parents to identify solutions together (called occupational performance coaching [OPC]), parents are increasingly efficacious in supporting their child (Graham et al., 2013).
Objectives: The aims of this study included: (1) Determine the feasibility (i.e., acceptability, satisfaction, cost-effectiveness of OPC for families of children with ASD delivered via telehealth; (2) Examine the extent to which OPC via telehealth impacted parent competence and child participation.
Methods: This study used a within group, pre-post quasi-experimental design. We enrolled n=17 families of children with (mean age=43.46 mos; SD=13.91 mos; range=26-63 mos). Parents completed the Telehealth Acceptability Questionnaire, a 14 item six-point scale (1=highly agree to 6=highly disagree) evaluating satisfaction with the use of telehealth as well as the intervention content/process. Parent report measures gathered pre- and post-12 weeks (i.e., parent competence, child participation). To address the cost-effectiveness of the intervention, we calculated the number of driving miles, travel time, lost family wages, and transportation costs at $0.54/mile. We used descriptives to examine telehealth acceptability and satisfaction. We used paired sample t-tests to analyze effects on parent efficacy and child participation
Results: To date, cost-effectiveness analyses show that the use of telehealth equated to $97,297.50 in savings when compared to traditional service delivery models. In addition, parents may lose approximately 11.3% of their income to receive services. The use of a telehealth method of intervention delivery was highly acceptable to parents (mean=1.18; SD=.39; range1-2.29). Parent also highly rated the intervention content/process (mean=1.18; SD=.21; range=1-2.14). Findings suggest that parent efficacy scores significantly increased (p<.05). In addition, children's frequency of activation participation significantly increased (p<0.01), and the diversity of children's activities significantly increased (p<0.01)
Conclusions: Telehealth is a promising method of delivery of OPC for families of young children with ASD, particularly for rural families and underserved families with limited access to services. A 12-week OPC intervention for families of children with ASD delivered via telehealth significantly increased parent efficacy and child participation. Results suggest that parents are highly satisfied with the content and process of this family-focused intervention, as well as the use of telehealth. When parents have the support of an occupational therapist to identify strategies that increase child participation in everyday activities, they likely feel increasingly efficacious in their parenting role.

188 **109.188** Outcomes for ASD Children with Feeding Problems in a Community Mental Health Setting

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Background: Although not a core feature of Autism Spectrum Disorder (ASD), children with ASD often have restricted food intake problems and disruptive mealtime behaviors. Escape extinction, a common evidence-based practice for restrictive food intake disorder for children with ASD, is controversial and considered unethical for many clinicians because of the aversive nature of the technique. Because of this, researchers and clinicians are striving to create and evaluate new feeding treatments for this population. An alternative feeding intervention with limited support in the ASD population is known as the Sequential Oral Sensory (SOS) feeding program. In an effort to improve the feeding behaviors of preschool children with ASD, a community mental health preschool program implemented a variation of the SOS intervention to determine its effectiveness. The feeding intervention is an intensive 8-month program, consisting of 30-minute sessions, 4 days per week, in a school cafeteria setting.
Objectives: We report findings from a longitudinal archival dataset collected during the implementation of a feeding intervention as part of a community mental health preschool program children with ASD. We examined the relationship between feeding behaviors and other client characteristics including age, sex, autism symptom severity, and cognitive ability. Discrepancies between clinician and caregiver reports of symptoms were also analyzed.
Methods: Sixty children ages 35 to 59 months diagnosed with ASD received a feeding intervention from a community mental health preschool program for eight months. The archival dataset included monthly administrations of the Brief Autism Mealtime Behavior Inventory (BAMBI) from both caregivers and clinicians. Severity of autism symptoms (Clinical Autism Rating Scale) and general cognitive ability (Psycho-Educational Profile) were also collected at intake and post-treatment. We used Hierarchical Linear Modeling (HLM) techniques to model the changes in BAMBI scores across the 8 months of treatment to assess effectiveness of the feeding intervention. We also used HLM to examine autism severity, age, cognitive ability, and gender of the client as potential predictors of treatment outcomes. Differences between caregiver and clinician reports of feeding behaviors at intake and post-treatment were examined using t-tests.
Results: Caregiver reported BAMBI score indicated that at post-treatment, 3 of the 53 children with significant feeding problems at intake no longer had significant problems post-treatment. This finding was not corroborated on the clinician report. HLM analyses show that reported problematic feeding behaviors over the course of treatment decreased significantly on caregiver report, but not on clinician report. Food selectivity significantly decreased on both caregiver and clinician reports. Cognitive ability at intake significantly predicted decreased food selectivity on the clinician report. Age, autism severity, and gender did not significantly predict treatment outcomes. Clinicians rated the feeding problems as more severe at intake than the caregivers. There were no significant differences between reporters at post-treatment.
Conclusions: The intensive feeding program implemented at a community mental health preschool program for children with ASD showed minimal effectiveness. This study highlights the difficulty of effective implementation of feeding interventions in community mental health settings. Implications, limitations, and future directions for research will be discussed.

189 **109.189** Outcomes of a Low-Intensity Early Behavioral Intervention Among Japanese Preschoolers with Autism Spectrum Disorders: A 1-Year Follow-up

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Background:
Studies suggest early intensive behavioral intervention (EIBI) can improve cognitive abilities, language, and adaptive behavior of young children with autism spectrum disorders (ASD). However, EIBI is unaffordable in many countries. Although it is essential to implement evidence-based early interventions for children with ASD with varied needs in community settings, evidence whether low-intensity early behavioral interventions (LBI) for ASD children contribute to improved outcomes compared to eclectic treatment-as-usual (TAU) in community settings is not well established.
Objectives:
This study aimed to examine whether LBI implemented in community settings helped to improve DQ and adaptive behavior of children with ASD compared to TAU.
Methods:
Sixty one preschool children diagnosed with ASD were recruited from several universities, private agencies, and regional public centers. After the exclusion of 8 children with a high DQ (DQ >84), the study sample consisted of 53 children: 27 participants (24 male) (mean age: 4.0 years; SD: 1.3; range: 2.1-6.7) receiving LBI (a mean of 3.8 hours per week; SD: 2.5; range: 0.8-8.0) and 26 participants (21 male) (mean age: 3.5 years; SD: 1.0; range: 2.3-5.9) receiving TAU (a mean of 18.2 hours per week; SD: 9.7; range: 0.5-25.3). Standardized tests were administered at baseline (T1) to assess mental age (DQ), adaptive behavior (VABS), ASD symptom severity (PARS), mental health problems, maternal parenting stress and depression, and again, 1 year later (T2). Intervention type, intensity and duration were also monitored after 6 months. There were no differences between groups for age, parental age or education at T1. A paired t-test was used to compare DQ and VABS scores for each group between T1 and T2. DQ at T1 in the TAU group was significantly higher than in the LBI group ($t = -2.284$ $p < .05$). Analysis of covariance was used to compare between-group changes in DQ and VABS scores.
Results:
Within the LBI group there was an increase in DQ ($t = -2.150$; $p < .05$), Language-Social DQ ($t = -3.221$; $p < .01$), and VABS Communication ($t = -2.267$; $p < .05$) score, and decreases in VABS Daily Living ($t = 2.758$; $p < .05$) and VABS Socialization scores ($t = 3.024$; $p < .01$) between T1 and T2. For the TAU group only Language-Social DQ ($t = -4.161$; $p < .01$) and VABS Communication ($t = -2.665$; $p < .05$) score increased. A between groups comparison revealed a greater increase in DQ in the LBI group than in the TAU group ($F = 4.129$; $p < .05$). There were no significant differences in the size of the score change between the groups for Cognitive-Adaptive DQ, Language-Social DQ, or the VABS scores.
Conclusions:
In this prospective observational study, preschool children with ASD receiving LBI, which included varied programs and a lower intensity intervention compared to in previous studies, had a greater improvement in DQ across a 1-year period compared to children receiving TAU, even though the mean intensity of the LBI intervention was less than the TAU intervention. RCTs involving larger samples are now needed to determine the evidence-based efficacy of LBI in community settings.

190 **109.190** Parent Training Via Telehealth for Children with Autism Spectrum Disorder and Disruptive Behavior: A Demonstration Pilot

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Background: As the number of cases of ASD has increased, so have the challenges of serving these children and their families. Telehealth is a potential solution to the problem of limited access to specialized services for children with ASD and families in rural areas. The Research Units in Behavioral Interventions (RUBI) PT program showed that a 24-week, structured parent training (PT) program was effective for reducing disruptive behavior in children with ASD when delivered 1:1 in a clinical setting. A promising expansion involves telehealth delivery of RUBI-PT, as this modality could increase access to care in rural and underserved communities.
Objectives: This open-label pilot study evaluated the feasibility and initial efficacy of the RUBI-PT program when delivered via telehealth to families of children with ASD and disruptive behaviors in rural areas. We define feasibility as evidence that the treatment is acceptable to families and therapists, that the outcome measures can be collected as scheduled, and that the treatment can be delivered reliably by trained therapists via telehealth. Efficacy was evaluated through change on the parent-rated Aberrant Behavior Checklist-Irritability subscale (ABC-I) and independent evaluator ratings of overall improvement on the Clinical Global Impression-Improvement (CGI-I) scale.
Methods: Parents of children ages 3-8 with a community diagnosis of ASD and disruptive behavior living in rural Georgia were enrolled in the 24-week study. The RUBI PT curriculum is based on principles of applied behavior analysis and provides parents with specific techniques to manage child behavioral problems and promote adaptive skills. Eleven core sessions and up to two supplemental sessions (e.g. toileting, feeding, sleep issues) were delivered over 16 weeks. Follow up telephone boosters were conducted at Weeks 18, 20, and 22 to promote skill generalization and maintenance. Assessments occurred at Baseline, Weeks 8 and 16 and 24.
Results: Fourteen children with a community diagnosis of ASD were screened and all met eligibility criteria. Families were recruited from 4 telehealth sites (2 schools, 1 primary care center, 1 regional medical center). Mean age was 5.8 ± 1.7 years; 64% were males; mean IQ = 69.4 ± 17.6. Thirteen of 14 families (92.9%) completed the 24-week treatment. Feasibility outcomes showed 98% therapist fidelity to treatment, high parental engagement in treatment (91.6% of core sessions attended) and 94.6% attainment of in-session goals. Despite the distance from the center, we were able to collect 95% of outcome data from parents and caregivers across the 24-week trial. Parents reported greater confidence in managing problem behaviors and both therapists and parents reported high levels of comfort with the telehealth technology. Regarding efficacy of the telehealth treatment, parents reported a 46.4% decrease in disruptive behaviors on the ABC-I at Week 24. Eleven of 14 (78.5%) participants were rated as much/very much improved on the CGI-I by an independent evaluator.
Conclusions: The delivery of PT via telehealth appears to be acceptable to parents and therapists. Preliminary efficacy findings are promising and suggest that delivery of the RUBI PT program via telehealth may produce notable reductions in parent-reported child disruptive and noncompliant behaviors.

191 **109.191** Parent-Based Intervention Therapy for Autism Spectrum Disorder

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Background: Â In India, >10 million children are affected by autism spectrum disorder (ASD). With improvements in diagnosis, the number of cases is expected to greatly increase; however, there continues to be a deficit of professionals in the field of autism intervention. Several studies have shown that a structured intervention for children with ASD at an early stage significantly improves IQ levels, adaptive behavior, and diagnosis of autism compared to children receiving community-based intervention. In this regard, parent-implemented intervention has shown better outcomes for both children and parents compared to other forms of intervention for ASD, and has extended the benefits of intervention to the home environment.
Objectives: Â This study aimed to provide timely intervention in children with ASD by training parents to be interventionists themselves.
Methods: Â Twenty-three children with ASD (3–7 years) were first diagnosed using standardized tools, and then, evaluated using the Early Start Denver Model Curriculum Checklist (ESDM) in the areas of communication (receptive and expressive), social skills, and play skills pre-intervention, and the modified Indian version of the MacArther Communicative Development Inventory. A comprehensive intervention plan was then designed to begin from the child's basal level of functioning, based on the above assessments. This included enhancing the child's social, communication, and self-help skills through play therapy, language sessions, phonetics and early literacy program, toilet-training program, self-help development program, and sensory program; 3 h/day at the center and at least 2 h/day at home for 5 days, leading to a 25-h structured intervention program weekly. We also focused on sensitizing and empowering parents through weekly presentations and home program to facilitate intervention during child's daily activities. Plans were reviewed monthly by staff and parents. Evaluation using ESDM checklist was performed after each of the four post-intervention sessions at 6-month intervals.
Results: Â Based on our pilot results, most children showed significant improvements in communicative abilities, play, and social skills at the end of 1–4 intervention sessions (1st session: n = 17; 2nd to 4th session: n = 6) as per the ESDM check-list. By the end of the first intervention session, 12/17, 9/17, and 10/17 children showed improvements in communication, social skills, and play, respectively. Among the 6 kids who have completed all 4 intervention sessions so far, all showed significant improvements in communication, social skills, and play as compared to pre-intervention ($p < 0.05$).
Conclusions: Â Based on our results, we can conclude that our parent-based intervention therapy has successfully enhanced the developmental outcomes for children with ASD. It has made parents more tuned-in to their child's needs and show child-oriented responses, sensitive to the challenges their child faces, have appropriate expectations from the child, and be more optimistic. Our results support previous research that suggests that close cooperation between parents and professionals as well as parental involvement is key to the success of autism intervention programs. We believe that involving parents/primary caregivers will compensate for the deficit of professionals in the field of autism intervention and help in effective and timely intervention in children with ASD.

192 **109.192** Parent-Child Group Intervention for Young Children with ASD

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Background: ASD affects approximately 1 in 68 children in the U.S., according to the Center for Diseases Control (Baxter et al., 2014). More children than ever are being diagnosed or identified as at-risk for ASD in the first years of life. Despite strong evidence for the positive impact of early intervention that begins immediately following diagnosis (Koegel et al., 2014), and despite evidence that intervention delivered in the first three years of life has higher impact on outcomes in comparison to later start (Vivanti et al., 2016), access to high quality treatment is quite limited, and this is particularly true for very young children. While we can identify early signs of ASD as early as 12 months of age, on average children with ASD in the U.S. start intervention after 3 years of age (CDC, 2016). Therefore, the majority of children miss an important developmental window shown to significantly improve children's outcomes. Barriers preventing very early access to intervention include a continuous increase in the number of children diagnosed, as well as scarcity of specialized providers. One way of increasing access to intervention is to teach intervention strategies to parents immediately after diagnosis.
Objectives: The aim of this project was to adapt an existing evidence based intervention, the Early Start Denver Model (ESDM) (Rogers and Dawson, 2010), to a parent-child group delivery in order to increase access to treatment in the period immediately following diagnosis, and thereby improve child outcomes.
Methods: The Parent-Child group ESDM was delivered to 5 young children with ASD, between 24 and 48 months of age, and their caregivers. Each family participating in the study received one 1-hour session per week of the treatment, delivered in a group of 5 child -caregiver dyads, for 12 weeks. During the first portion of each session the therapist covered an ESDM teaching strategy with the caregivers, while the children played under the supervision of student research assistants. During the last portion of the session, the caregivers joined their children and practiced the ESDM teaching strategies with the coaching of the therapist.
Results: Preliminary data indicated gains in social-communication behaviors in children. Acceptability of the program was very good as indicated by retention of all participants. Moreover, results from a five-point Likert-based scale survey indicated that the caregivers agreed or strongly agreed that the program was useful and satisfying.
Conclusions: Our preliminary results suggest that the ESDM delivered in group may be useful to teach intervention skills to parents and to increase social communication in young children with ASD.

193 **109.193** Parental Perspectives on Parent-Mediated Intervention for Toddlers Suspected of Autism Spectrum Disorder to Support Parent during the Waiting Period Surrounding the Diagnostic Evaluation

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Background: Â Knowing that interventions for children suspected of autism spectrum disorder (ASD), are most effective when offered as early as possible, interventions that are tailored to very young children presenting early difficulties in social interaction or communication is needed. Parents-mediated interventions may be a useful way to support developmental and functional outcomes in vulnerable young children and to bring benefits to the whole family by improving the parents' sense of competence and empowerment.
Objectives: The study aims to assess the effects of a 12-week parent-mediated intervention adapted from the Early Start Denver Model (ESDM) and the Social Communication Emotional Regulation Transactional Support (SCERTS) model for families with low-socioeconomic status (SES) having a toddler suspected of ASD on 1) parents' use of strategies, 2) parent-child interactions, and 3) parental well-being.
Methods: The proposed intervention offers 12 individual coaching sessions to parents of children suspected of ASD at their home on how to interact with their young children and thus stimulate their development through daily interactions. An experimental study was conducted with 19 families with low SES having a child with a suspicion of ASD aged between 15 and 30 months and at least one of their parents, randomly assigned to the group receiving the intervention right away (group 1) or having to wait 3 months before having access to the intervention (group 2).
Parental perspectives were collected three to four times; before waitlist (T0, only for group 2), pre-intervention (T1), post-intervention (T2), and three-month follow-up (T3) and analyzed using Mann-Whitney and Wilcoxon signed-rank tests. Parents' use of strategies and parent-child interactions were rated using respectively the ESDM Fidelity Checklist and Adamson's engagement rating scale via videotapes of a 10-minute free play period between the child and his parent at each assessment time. Parental well-being was assessed through two questionnaires completed by parents themselves, the Parental Stress Index – Short Form (PSI-SF) and the Parent Sense of Competence (PSOC).
Results: 18 of the 19 parent-child dyads participated in the 12 weekly parents coaching sessions. Data analysis shows significant improvement in parents' use of strategy and parent-child interactions during the intervention phase (T1 – T2), but no significant change before (T0 – T1) or after intervention (T2 – T3). Regarding parental well-being, no significant changes were noted in parental well-being at any time points.
Conclusions: This study shows promising results on proximal outcomes (parents' use of strategies and parent-child interactions). Knowing so, parent-mediated interventions may be an interesting alternative to increasing timely access to interventions, especially before children has any diagnosis, and thus very few services. In fact, this study shows that it helps parents to use strategies to promote their child's development and to interact adequately with their child during free play periods. However, parental support should be targeted more specifically to improve parental well-being. Also, more distal outcomes, such as child development and parental satisfaction toward the program should be assessed.

194 **109.194** Pilot Study of a Comprehensive Psychosocial Summer Treatment for Young Children with HFASD

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Background: The number of children diagnosed with autism spectrum disorder (ASD) has been increasing at an alarming rate, highlighting the need for effective treatments (Odom et al. 2014). The concentration of the increase among young high-functioning children with ASD (HFASD) poses a significant challenge, as specialized treatments for these young children are non-existent. While a growing body of evidence suggests that cognitive-behavioral treatments for youth with HFASD may yield positive outcomes (e.g. Laugeson et al. 2012; Frankel et al. 2010), their use with young children with HFASD has not been evaluated.
Objectives: This study examined the feasibility and initial outcomes of a comprehensive summer psychosocial treatment (summerMAX^{yc}) for 23 young children, aged 4-6 years with HFASD.
Methods: *Participants:* The sample included 23 children, aged 4-6 years with HFASD. Each child had a prior clinical diagnosis of ASD, an SB-5 abbreviated IQ >70 (at least 1 subtest >80), and a PLS-5 expressive or receptive language score >80. All diagnoses were confirmed using the ADI-R. *Measures:* Social Responsiveness Scale - Second edition (SRS-2), Adapted Skillstreaming Checklist for Young Children (ASC^{yc}). *Procedures:* The 5-week cognitive-behavioral treatment (5 days/week, 6 hours/day) included instruction and therapeutic activities targeting social/social-communication skills, facial-emotion recognition, and interest expansion. A behavioral system was also implemented to reduce ASD symptoms and problem behaviors and/or increase skills acquisition and maintenance. Rating scales were completed pre- and post-treatment by parents and staff clinicians.
Results: Feasibility was supported in high levels of treatment fidelity (all components >93%) and parent- and staff-reported satisfaction. Satisfaction ratings averaged 67.3 out of a maximum of 70 points (average item *M*=6.7 of a maximum 7) for parents and 45 out of a maximum of 49 points (average item *M*=6.4 of a maximum 7) for staff-clinicians. Average child satisfaction total was 14.5 of a possible 15 points (average item *M*=2.9 of a maximum 3). According to parent and staff-clinician ratings, children displayed significant reductions in ASD symptoms and gains in their use of targeted social skills. Pre-post comparisons indicated a significant decrease in parent (SRS-2 $p<.001$, $d=1.70$) and staff-clinician (SRS-2 $p<.001$, $d=1.29$) rated ASD symptoms, and increase in parent (ASC^{yc} $p<.001$, $d=1.68$) and staff-clinician (ASC^{yc} $p<.001$, $d=2.30$) rated social/social-communication skills.
Conclusions: Overall, results suggested that the comprehensive young child protocol (summerMAX^{yc}) can be conducted with a high degree of accuracy (fidelity), parents, children, and staff-clinicians find it quite acceptable, and participation is associated with significant symptom and skills improvements. These findings were considered especially promising as the effect sizes on the two parent and staff-clinician rating measures were large (*d*s 1.29 and 2.30). Results also suggested that cognitive-behavioral techniques/treatments may be appropriate for young children with HFASD. Despite these initial positive indications, the results must be considered suggestive and the summerMAX^{yc} protocol requires examination in an RCT.

195 **109.195** Real-World Conversational Turn-Taking: An Exploratory Study of Preschoolers with ASD, Teachers, and Peers

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Background:
Early intervention (EI) has the potential to dramatically improve long-term outcomes in children with ASD (Howlin, Magiati, & Charman, 2009). Little is known about the influence of child-level characteristics on treatment gains in different EI settings, which could have important implications for how we match children to the most effective setting. Language may be an important moderator of individual gains. For example, a study of preschoolers with ASD revealed that children with higher standardized language scores at the beginning of the school year demonstrated steeper rates of cognitive growth in inclusion classrooms than in mixed disability or inclusion classrooms (Nahmias et al., 2014). In this study, we explore a hallmark of social communication: conversational turn-taking (Dykstra et al., 2013; Warren et al., 2010). Conversational turn-taking is a dynamic, ecologically valid measure of social communication that may vary across different EI settings. Defining child and classroom factors that facilitate conversational turn-taking could guide placement decisions, particularly if more turn-taking results in greater long term social and cognitive growth.
Objectives:
To assess conversational turn-taking in preschoolers with ASD, their teachers, and their peers during free play in three EI classroom settings (autism-only, mixed disability, inclusion), and compare profiles of children who engaged in peer conversations with children who did not.
Methods:
Twenty-four preschoolers with ASD (16 boys, M=4.1 years, 88% scored "very low" on the Mullen ELC) wore t-shirts with digital language recorders (LENA) in a child-safe chest pocket during a typical school day. All verbalizations produced by or directed at the target child during an unstructured "free play" sample were orthographically transcribed (M=19.0 minutes). We defined conversational turns as pauses of greater than 0 seconds and less than 4 seconds between utterances by different speakers (target child, peer, teacher). Dependent variables included turn-taking rates relative to total recording duration and inter-turn latency.
Results:
All 24 participants engaged in conversational turn-taking with teachers, but only 38% conversed with their peers. Children who engaged in peer conversational turn-taking (PC) were more likely than those who did not (N-PC) to be in inclusion classrooms (Chi-square = 7.22, $p<.05$), and in classrooms with more students ($p<.05$). PC and N-PC had statistically equivalent SCQ and ADOS severity scores, but PC had higher Mullen expressive and receptive language scores than N-PC ($ps<.05$). Rates of teacher-participant conversational turn-taking did not differ by setting, and teachers responded equally quickly to children in both groups.
Conclusions:
This exploratory study is part of a larger, longitudinal effort to examine mediators and moderators of intervention response in preschoolers with ASD, and is one of the first to analyze fine-grained measures of conversational turn-taking in different EI settings. Our finding that more peer conversations occur in inclusion classrooms suggests enriched opportunities for peer interaction in that setting compared with autism-only and mixed disability classrooms, but children in inclusion classrooms also had higher baseline standardized language scores. Future analyses with additional participants will assess the differential effects of child/classroom language variables (including conversational turn-taking) on cognitive and social growth over 9 months.

196 **109.196** Reduced Anxiety Following Pivotal Response Treatment in Young Children with Autism Spectrum Disorder

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Background: Up to 40% of children with ASD exhibit co-occurring symptoms of anxiety, further impairing social functioning. Despite recent successes in mitigating anxiety symptoms in school-aged children with ASD using adapted versions of Cognitive Behavioural Therapy, little is known about treatments for younger children. Pivotal Response Treatment (PRT) is a behavioural intervention that primarily aims to increase social communication skills in children with ASD by reinforcing social interactions in a naturalistic and contingent manner. To date, no studies have explicitly examined the therapeutic potential of PRT at reducing anxiety symptoms in young children with ASD.
Objectives: To explore changes in anxiety in young children (4-8 years) with ASD following a 16-week open-label trial PRT. We examined whether changes in anxiety may be independent from co-occurring changes in social communication skills, which is directly addressed by PRT, to hypothesise and evaluate whether any changes observed in anxiety may be driven by differential therapeutic elements of PRT.
Methods: Participants included 21 children (9 female, 12 male) with high-functioning ASD (M IQ=102, SD=16, measured by Differential Abilities Scale – 2nd Edition) between the ages of 4 and 8 years. Each child received three treatment sessions, with a total of 7 hours, on a weekly basis for 16 weeks. Parents completed outcome measures both before and after the 16 weeks of PRT. We conducted paired sample t-tests to evaluate changes in anxiety (Child and Adolescent Symptom Inventory – Anxiety Subscale, CASI-Anx), internalising symptoms (Child Behaviour Checklist – Internalising domain), and social communication (Social Responsiveness Scale, SRS) over the course of treatment. We conducted repeated-measures ANCOVA to evaluate changes in anxiety after controlling for changes social communication. Finally, we partitioned the variance of change observed in anxiety over the course of treatment, by including changes observed in social communication (SRS), IQ, and age in a step-wise hierarchical regression analysis.
Results: Participants showed significant reductions in anxiety (CASI-Anx) from pre-treatment to post-treatment (CASI-Anx Total; $p = .02$), internalising symptoms (CBCL; $p = .001$), and social communication (SRS; $p = .001$) (Table 1). After controlling for changes in social communication, participants still showed a significant reduction in anxiety, $F(1,19) = 6.13$, $p = .023$, partial $\eta^2 = .24$. Hierarchical linear regression model (Table 2) showed that residualised change in social communication accounted for little variance associated with change reported in anxiety, $R^2 = .02$, $p = .55$. Further addition of IQ and age, as covariates did not alter the model's ability to account for changes observed in anxiety over PRT.
Conclusions: This open-label study shows promising results for PRT to help reduce anxiety, and internalising symptoms more broadly, in young children with ASD. To our knowledge, this study is the first to address the gap in literature on evaluating anxiety reduction following intervention in young children with ASD, providing evidence supporting PRT's significant additional therapeutic potential in terms of reducing severity of anxiety. Future studies can evaluate whether current finding may hold using larger sample sizes, and translated to lower-functioning young children with ASD.

197 **109.197** Role and Predictors of Therapeutic Alliance in a Parent-Mediated Intervention for Autism

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Background: Therapeutic alliance is a measure of the quality of the working relationship between therapist and client. In psychiatry, meta-analyses have shown a small but consistent relationship between quality of alliance and outcome for both adult (Horvath, Del Re et al. 2011) and child/youth clients (Shirk, Karver et al. 2011), and a range of factors have been shown to associate with the quality of alliance. However, therapeutic alliance has been little researched in the context of parent-mediated interventions for children with autism.
Objectives: To investigate the relationship between parent-therapist alliance and a range of baseline and process variables, and the role of alliance as a post-randomisation effect modifier on parent and child outcomes, in a parent mediated intervention for autism.
Methods: Therapeutic alliance was rated at three time points by 77 parents and 6 therapists participating in the Pre-School Autism Communication Trial (Green, Charman et al. 2010). This was a randomised control trial of a parent-mediated intervention for autism (Pre-school Autism Communication Therapy; PACT), compared against treatment as usual (TAU). Baseline variables comprise parent demographic variables, parent causal belief variables, and an average therapist fidelity variable. Process variables comprise parent 'Expression' and therapist 'Integration' of parent perspectives, measured on the Parent Perspectives Coding Scheme (PPCS), developed specifically for the study. 120 sessions from a purposive high-low parent-rated alliance subsample of 20 cases were coded on the PPCS. Since alliance is not measurable in the TAU arm, we use significant predictors of alliance to predict the 'counterfactual alliance' that would have been observed in the PACT arm for those randomised to TAU. This forms latent classes of alliance, and we compare outcomes, including measures of parent synchrony, child initiations and symptoms, between PACT and TAU within each of these latent classes.
Results: Parent-rated and therapist-rated alliance did not correlate. Parents who cited MMR as a possible cause of autism in their child rated the alliance lower than those who did not ($p<.05$) and parents with no post-16 qualifications rated the alliance higher ($p<.05$); these two variables were independent. A multiple regression model including the two variables in a single step explained 18.3% of variance in parent-rated alliance (Table 1). PPCS Expression and Integration scores were higher in the high parent-rated alliance group but the difference was non-significant. Therapist-rated alliance associated positively with therapist fidelity ($p<.01$) and with PPCS Expression and Integration variables ($p<.01$). A multiple regression model containing fidelity, expression and integration explained 58.8% of variance in therapist-rated alliance (Table 2). The analysis of alliance and treatment effects is underway and results will be included in the presentation.
Conclusions: Therapists should be aware that parents may rate the alliance differently from themselves and that different factors associate with their ratings. Parents' causal beliefs and level of education may influence their ratings of alliance in specific interventions. In keeping with alliance theory, open discussion of disagreement may improve alliance in these cases, especially where the parents' views on causal beliefs are unlikely to be shared by the therapist.Â **Â**

198 **109.198** Scoping the Evidence of the National Autistic Society (NAS) Early Bird Parent Education Training Programmes

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Background:
The EarlyBird (EB) programme is a Parent Education Training (PET) programme designed to assist parents and caregivers shortly after their child is diagnosed with an Autism Spectrum Disorder (ASD). The United Kingdom-based National Autistic Society (NAS) developed the twelve week group-based programme in 1997. Its broad aims are to 1) support parents immediately after diagnosis, 2) empower parents and encourage a positive perception of the child's ASD, and 3) help parents establish good practice. The EarlyBird Plus (EB+) course was designed in 2003 for parents of school-going children under the age of 9 years.
Both programmes are run internationally in many High Income Countries (HIC), and more than 20,000 families to date have attended the courses. Many clinical and research teams in low- and middle-income countries (LMIC) and other low-resource settings are seeking appropriate evidence-based parent education programmes to implement in these settings, where parent support is severely lacking. EB/EB+ may potentially fill such a need.
Objectives:
This study set out to perform a comprehensive scoping review of all peer-reviewed publications on the acceptability and outcomes of the EB and EB + programmes. We reviewed the context for programmes, study populations, design, outcome measures used, and overall evidence-base.
Methods:
A search was conducted between February and June 2016 using the following databases: EbscoHost, Sabinet, SAGE journals, Directory of Open Access Journals, BioMed Central, Scopus and Science Direct, as well as 'grey literature'. The searches were conducted using the following keywords: EarlyBird, EarlyBird Plus, Autism, Parent Skills Training, Psychoeducation, Parent Support, Parenting Programmes, and Parent Training. Two reviewers independently screened titles and abstracts of publications using the inclusion criteria.
Results:
The review identified 18 articles of which two were from New Zealand and 16 from the United Kingdom. No publications were identified from LMIC. Thirteen of the articles emphasised that the EB and EB+ programmes met their aims and parental satisfaction regarding the course was high. 72% of studies were non-randomized pre-post control in design and only one had a control group.
Acceptability of the programmes was reported on in 94%, and efficacy in 72%. Outcome measures included parental stress, parental perceptions severity of symptoms and of the intervention, parental knowledge and child adaptive behaviour. No randomized controlled trials or head-to-head studies with other parent education training programmes have been performed using of EB/EB+ to date.
Conclusions:
In spite of its widespread use, the evidence-base for EB/EB+ was surprisingly small, and was limited to findings from two English-speaking high-income countries. Whilst there is no doubt about the potential usefulness of these programmes, our findings suggest that much further research evidence may be required in order to determine the potential usefulness and appropriateness of these programmes in low-resource environments. Apart from the need for study designs other than pre/post designs, careful consideration should also be given to acceptability and cultural appropriateness, to outcome measures (including parent-child or child-specific), and to the potential scalability of such interventions.

199 **109.199** Social Responsiveness Gains and Predictors of Outcome Associated with Social Pivotal Response Treatment for Toddlers with ASD: Results of an Ongoing RCT

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Background: Â During the early years of life, the ability to orient one's attention to social cues of others, particularly parents, is imperative to development and social learning. Toddlers with autism spectrum disorder (ASD) demonstrate significant vulnerabilities in early engagement skills, such as social orienting and joint attention behaviors, which are found to be significant predictors of later language ability (Dawson et al., 2004). Specifically, known decreased sensitivity to visual and auditory social stimuli in their environment may lead to long-term negative effects on social, emotional, and language development (Dawson et al., 2002; McPartland et al., 2011). Early interventions that integrate social elements into reinforcement paradigms can dramatically improve collateral levels of interpersonal engagement (Vernon et al, 2012). This current investigation examined child responsiveness to parent engagement bids and its predictability of expressive language gains as a result of Pivotal Response Treatment.
Objectives: This investigation focused on evaluating toddler social responsiveness to parent social bids in naturalistic play probes. Additionally, the study investigated whether pre-intervention levels of engagement could both (1) function as an accurate outcome predictor of expressive language abilities and (2) be improved in a PRT paradigm that emphasized engaging social exchanges.
Methods: Participants were 19 toddlers (18-48 months) with ASD enrolled in an ongoing randomized controlled trial. Participants were age-matched and randomly assigned to a treatment (6 months of PRT focusing exclusively on social routines and reinforcers) or waitlist condition. At pre and post, all participants engaged in a five-minute structured laboratory observation (SLO) with their parent, in which parents were instructed to play with their child using a standardized set of toys. SLOs were coded for parent social play bids and the quality and frequency of child's social responses. Additionally, videos were transcribed as a naturalistic measure of expressive language abilities. A repeated measures analysis of variance was conducted to assess for child engagement and language skills between groups before and after intervention.
Results: Â When examining gains in global social responsiveness (verbal and nonverbal responses) to parent bids, results indicated a medium effect (ηp2=.06, d=.78) in the treatment condition compared to waitlist controls. Specifically for verbal social responsiveness, treatment participants exhibited improvements indicative of a large effect (ηp2 =.18, d=1.13) not observed in the waitlist condition. We can conclude that participation in a social PRT paradigm was associated with significant increases in social responsiveness and verbal engagement in response to parent social bids in naturalistic situations. Level of social responsiveness to parent bids at pre-intervention was correlated with several post-intervention language variables: number of total words (r^2=.59, *p*=.03), number of novel words (r^2=.67, *p*=.01), and average length of utterance (r^2=.78, *p*=.002). While responsiveness to parent bids only required participants to engage nonverbally, pre-existing levels of engagement were significantly associated with resulting expressive language abilities following intervention.
Conclusions: Low levels of engagement with parents are malleable to change as a result of social engagement intervention. Upon further exploration, this nonverbal naturalistic assessment may prove effective for predicting responsiveness to early intervention for minimally verbal children with ASD.

200 **109.200** Tailoring an Evidence-Based Practice to Parents Raising Preschoolers with Autism: Strengths, Challenges, and Future Research Directions

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Background: Parent strain and burden are high in families raising children with Autism Spectrum Disorder (ASD). Parents of preschool children with ASD in particular are particularly vulnerable to stress and depression. Poor parent mental health is associated with several negative outcomes, including child social difficulties, strained parent-child attachment, and marital unhappiness. Yet, few interventions address the direct needs of this growing population of parents.
Objectives: The current study evaluated the outcomes of an existing evidence-based parenting program, The Incredible Years, adapted to caregivers of young children with ASD. The program focuses on improving child-parent communication, problem solving, stress management, and school readiness, as well as to reduce challenging child behaviors and poor family dynamics.
Methods: Seven groups of parents in two sites participated in a pilot trial with no comparison group of the 12-week intervention. Participants were recruited from a community convenience sample. Pre/post changes in parenting stress using the Parenting Stress Index, caregiver coping using Ways of Coping Questionnaire, and child behavior using the Aberrant Behavior Checklist were examined, as well as acceptability and fidelity measures available in the Incredible Years manual. Data were analyzed with two-tailed, paired t-tests ($p<.05$) and basic descriptive statistical procedures using SPSS.
Results: Of the 46 parents who completed baseline measures, 37 completed the program (80.4%). Most participants were mothers and married. The majority of caregivers identified as White (67%) or Latino/a (30%). Approximately two-thirds of the participants had a college degree or more. Participants reported a range of household income levels, with nearly a quarter of respondents noting a household income of less than $25,000. A minority of caregivers had mental health issues (15%).
Fidelity to the manualized intervention was maintained throughout the program period. Child-related parenting stress significantly declined at posttest, with a mean percentile decrease of 6 points (95% CI: .83, 11.02). Child irritability and agitation significantly decreased by 3 points (95% CI: .42, 6.17), and child lethargy and social withdrawal by 2 points (95% CI: .39, 4.20). While improvements in caregiver coping skills and child hyperactivity and non-compliance trended in the expected directions, the changes were not statistically significant. Acceptability was high among graduates of the program, particularly regarding the play-based approach of the program with specific skills in improving parent and child emotion regulation, as well as opportunities for social support and peer learning. Participants' most common recommendation for improvement was to extend the program's duration.
Conclusions: Â The Incredible Years is a promising practice for parents raising preschoolers with ASD. A randomized controlled trial is needed to rigorously test the intervention. Specifically, more research is necessary to investigate further intervention modifications to improve outcomes for young children with ASD and their parents.

201 **109.201** Teacher Perceptions and the Implementation of Jasper for Students with ASD

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Background: Â Children with autism spectrum disorder (ASD) are less likely to be jointly engaged with a play partner than typically developing children (Adamson, Bakeman, Deckner, & Romski 2009). Joint engagement during play provides educators an optimal environment to teach social communication skills. It is especially important for teachers to use strategies that promote engagement for students with ASD. However, teacher perceptions of their students' behavior may influence social interaction strategies.
Objectives: Â We aimed to investigate how teachers' perceptions about students with ASD influenced use of joint engagement strategies during dyadic play interactions. We examined how teachers perceived students' ability to control their ASD related behaviors, and how this perception relates to joint engagement strategies.
Methods: Â Data were analyzed from a study implementing a targeted social communication intervention (JASPER) in preschools (Chang, Shire, Shih, Gelfand, & Kasari, 2016). Participants included 66 preschool students with ASD (mean age = 48 months), 82% male, and from diverse ethnic backgrounds (12.1% African American, 30.3% Caucasian, 18.2% Latino, 15.2% Asian, and 18.2% other). Twelve teachers from six ASD preschool classrooms located around the Los Angeles area participated. The schools were randomized to receive teacher training or placed on a waitlist. Pre-intervention, teachers completed questionnaires rating their students' effortful control over behaviors associated with ASD:Â social interaction, non-verbal communication, repetitive interests/behaviors, and sensory seeking behavior. For these four domains, teachers read a description of behaviors associated with ASD, and rated each child (1-5) on their ability to control those behaviors. Scores across all four domains were totaled to create a composite score representing teachers' perceptions of each student's ability to control ASD related behaviors (M = 3.06, SD = .988). Teachers and students were filmed during a ten-minute play interaction, before and after receiving JASPER training. Videotapes were scored for use of strategies to promote joint engagement during play, resulting in overall teacher strategies scores.
Results: Â First, multiple regression analysis from pre-intervention was conducted on the entire sample. At entry, teachers' perceptions of a student's ability to control ASD behavior predicted overall teacher strategies scores, accounting for students' expressive language ability (β = .064, p = .01). Teachers' perceptions accounted for an additional 14% of variance in teacher strategies scores (ΔR^2 = .144). A separate regression analysis was conducted for the group that received JASPER. Teachers' perceptions were not related to changes in strategy scores after receiving JASPER training (β = -.029, p = .44, ΔR^2 = .034).
Conclusions: Â Teachers' perception of students' ability to control ASD behavior is associated with strategies used during play interactions. Prior to training, teachers tended to use strategies promoting joint engagement for students who were perceived to be better able to control their ASD behavior. However, these perceptions did not interfere with teachers' ability to learn and implement intervention strategies. Teachers made significant improvements in using intervention strategies across students (Chang et al., 2016), and these improvements were not related to their initial perceptions of students' ability to control ASD behavior.

202 **109.202** Telehealth Delivery of a Caregiver-Mediated Intervention for Minimally Verbal Children with ASD

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Background: It is estimated that 25% to 30% of children with Autism Spectrum Disorder (ASD) remain minimally verbal (i.e., using fewer than five words on a daily basis; Tager-Flusberg & Kasari, 2013; Lord et al., 2004). Intensive behavioral interventions for children with ASD often focus on social initiations such as requests as initial targets for language development (Sundberg & Partington, 1998). Request training teaches individuals to initiate communication with others by incorporating behavioral techniques (e.g., environmental manipulations, prompting, and reinforcement) within naturalistic teaching opportunities (Paul, 2008), and can be implemented through direct services or delivered as a caregiver-mediated intervention (Loughrey et al., 2014). Several barriers to accessing evidence-based treatment for children with autism are common, including lengthy time commitment and geographical restrictions (Thomas et al., 2007). Parents of children with ASD have specifically recognized the need for greater access to applied behavior analysis services (Dymond et al., 2007). Prior studies have provided promising evidence of the utility of telehealth technology to deliver behavioral services to children with ASD (e.g., Wacker et al., 2013; Vismara et al., 2012 and 2013); however, research is limited.
Objectives: The current study aimed to evaluate the feasibility, caregiver satisfaction, and preliminary efficacy of a caregiver-mediated intervention delivered via telehealth to improve expressive language of 15 young children with ASD and severe language delays.
Methods: Fifteen minimally verbal children (ages 2 to 4 years) with autism were enrolled in a 12-week caregiver-mediated request training intervention. All participants were diagnosed with ASD using gold standard assessment procedures, and the average Mullen expressive language t-score of the sample was 23.72 (SD = 8.46; Mean AE = 13.63 months). The study utilized a within-group design and compared child vocalization outcomes at pre- and post-intervention, as well as at 1-month follow-up. Intervention procedures were based on Loughrey et al. (2014), and included didactic teaching, video modeling, practice, and feedback.
Results: Data were collected utilizing both direct and indirect measures that assessed feasibility, caregiver satisfaction, and preliminary efficacy. Out of 15 enrolled participants, the majority (66.67%) completed the entire study. Session attendance was high (M = 82.21%, SD = 13.66%), all participants (100%) reported satisfaction with the services their child received, and most (88.89%) reported that they would participate in telehealth services in the future. During a naturalistic observation from pre- to post-treatment, most children (80%) made gains in unprompted requests, and half (50%) made gains in spontaneous comments.
Conclusions: Our study provides preliminary support for the feasibility and efficacy of a caregiver-mediated intervention to increase language skills in minimally verbal children with ASD delivered entirely through the use of telehealth technology. Given that many young children with ASD do not develop functional communication skills without intervention (Eigsti et al., 2011) and that there are significant barriers to accessing evidence-based treatment, a time-limited and easily accessible intervention such as the one utilized in our study has the potential to make a large positive impact on this population.

203 **109.203** The Effectiveness of an Intensive Training Program on ORAL Productions on Children with Autism Spectrum Disorder

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Background: The development of speech in children with autism spectrum disorder is one of the top parental priorities and expectations. This development is not always predictable, being variable from child to child. Addressing this issue, it was developed an Intensive Training Program that integrates speech therapists that work on a daily or three times a week regimen this particular area of development. The aim of this study was to analyze, as a proof of principle, the evolution of portuguese phonemes productions of two children after the intensive training program.
Objectives: This study is descriptive and exploratory, based on two case studies of four years old male children, diagnosed with grade three autism.
Methods: They attended the intensive training for six months, one of them on a daily regimen and the other one three times a week, with four hours sessions. Quantitative data was collected by filling an evaluation table containing all portuguese phonemes that classified the productions based on their acquisition level. The evaluation was performed in a passive fashion, without interference in children's activities. The program took place in a structured environment after giving informed consent by children's parents.Â .
Results: Â the quantitative results showed an increase in verbal production in both cases. Regarding the types of vocalizations, there was a significant decrease of the stereotyped productions and an increase of the emerging productions. In recent months, the results showed that the children were starting to do specific productions after the therapists models. The results also showed significant differences between the two children, as it was noted a greater change in the case submitted to a daily training.
Conclusions: Â Future research should continue to focus on the influence of an intensive training in the development of speech and its communication functionality. It would also be important to compare different groups of children, one submitted to the program and the other submitted to weekly therapies.

204 **109.204** The Pediatric Developmental Passport: How to Ensure Our Families Are Accessing the Right Care

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Background: The Pediatric Developmental Passport (passport) is an innovative tracking tool for families of children with autism spectrum disorder (ASD). It provides a mechanism for clearly communicating appropriate regional developmental services, an opportunity to track progress in accessing these developmental services and a valuable summary of the developmental care received by that child for the pediatrician. A qualitative study with parents and health professionals (developmental pediatricians, developmental nurses, pediatricians) lead to the design and iterative review of the passport.
Objectives: The objective of this study was to determine the generalizability and effectiveness of the passport compared to placebo in a multi-site pragmatic randomized control trial.
Methods: A pragmatic multi-site randomized controlled trial was conducted with families of children between 0-6 years of age diagnosed with ASD. Families from two different models of developmental care were enrolled into the study. One site was a community based developmental consultation clinic and the second site was an academic developmental practice that provides longitudinal follow up. All families included in the study were randomized to receive the passport or placebo. Regional agencies that provided publicly funded ABA and parent education services were contacted directly to obtain accurate contact and access status of recommended developmental services. The effectiveness of the passport at each site was measured via chi square test at a p value of <0.05.
Results: Forty children with ASD were included and followed in this study, 20 from each site. At the community site, 90% of families that were given the passport contacted ABA services, compared to the 40% in the placebo group (p value = 0.024). There was no significant difference in the proportion of families that contacted ABA services at the academic site (90% in both arms). Comparison of the passport and placebo groups at within each site indicated no significant difference in the proportion of families that contacted parent education services. A significant difference was found in the proportion of families that contacted parent education services between the academic and community sites (60% vs. 19%, p=0.011).
Conclusions: Families that receive a diagnosis from consultation clinics are expected to follow up with a primary care physician. The differences observed in this study indicate that families that receive a diagnosis from this model of healthcare may benefit from further support to contact and access developmental services. The Pediatric Developmental Passport shows evidence as an effective tool to support families post diagnosis in this pilot RCT. With the Passport, the proportion of families that accessed ABA services increased to be equal to those who were followed longitudinally within an academic developmental practice.
Larger trials are being developed to further evaluate the Passport within different types of practices and different populations.

205 **109.205** The Relationship Between Duration and Outcomes in Young Children on the Autism Spectrum Using a Specialised Intervention

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Background: Previous research has shown that early intervention results in improved outcomes for children on the Autism Spectrum. However, there is limited data and mixed findings on the impact that duration of time spent in therapy has on treatment outcomes. While some studies have shown that minimal significant gains occur after one year of intervention, others have indicated that children receiving more specialised interventions demonstrated marked improvements with increased time spent in therapy (Cohen, Amerine-Dickens, & Smith, 2006; Howard, Stanislaw, Green, Sparkman, & Cohen, 2014; Virues-Ortega, Julio, & Pastor-Barriuso, 2013). These researchers argue that specialised interventions are generally focused on building foundational skills within the first year, while the second year helps to further develop and solidify these skills (Howard et al., 2014). Although there are a few interventions classified as specialised, to date, much of the research has focused on Applied Behaviour Analysis. Therefore, it is important to investigate whether this finding is limited to ABA or extends to other specialised therapies.
Objectives: The objective of the current study was to evaluate the relationship between duration of a specialised intervention, specifically the Early Start Denver Model (ESDM), and outcomes including symptoms of autism, cognitive ability and adaptive behaviours.
Methods: Children on the autism spectrum were aged two to five attending an autism specific preschool program receiving the ESDM early intervention program were evaluated at the beginning of the intervention program, and followed up every 12 months until they exited the preschool. Correlation and Regression analysis were used to assess the relationship between months children spend in therapy and outcomes in assessments. These included the Autism Diagnostic Observation schedule, the Mullen Scales of Early learning, Vineland Adaptive Behaviour Scales, Social Communication Questionnaire and the Repetitive Behaviour Scale.
Results: Increased time spent in therapy was associated with improved outcomes across a number of domains after controlling for potential moderators, including cognitive ability, age at enrolment, severity of symptoms and intensity of intervention. These included communication skills, daily living skills, interpersonal relationships, coping skills and adaptive behaviours. Interestingly, there was no association between improvement in receptive and expressive language and the duration of intervention.
Conclusions: Our findings demonstrate that early intervention is beneficial for preschool children on the autism spectrum, with increased duration of specialised intervention associated with improved outcomes across specific domains of functioning. These associations are in keeping with the domains that were the target of the intervention. However, further improvements in receptive and expressive language were not associated with the duration of intervention. It is unclear whether this finding indicates that children received the maximum benefit on receptive and expressive language skills after the first year of intervention or whether other factors outside of the ones accounted for played a role. Overall, this study supports the idea that increased time spent in specialised interventions improves specific outcomes.

206 **109.206** The Relationship Between Intervention Fidelity and Child Social Communication Gains in a Parent-Mediated Intervention.

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Background:
Parent-mediated naturalistic developmental behavioral interventions (NDBIs; Schriebman et al., 2015), teach caregivers to increase their responsiveness to their child's behavior and to elicit communication and play within child-directed activities. Previous research on a parent-mediated NDBI, Project ImPACT, has shown improvement in parent fidelity and rate of child language targets (Ingersoll & Wainer, 2013; Ingersoll et al., 2015); however, the relationship between parent use of specific fidelity components and broader child social communication outcomes is less clear. In this study, we examined the association between parent changes in Project ImPACT fidelity and child improvement on the Brief Observation of Social Communication Change (BOSCC; Grzadzinski et al., 2016).
Objectives:
We examined whether improvement in parent use of Project ImPACT intervention strategies was associated with improvement in child social communication on the BOSCC. We hypothesized that improvements in several key dimensions of parent fidelity (parent responsiveness, parent elicitation of child initiations, and parent prompting and reinforcement of child language) would be associated with improvements in child social communication on the BOSCC, whereas changes in other dimensions (parent modeling of language, parent prompting of child play skills) would be less closely associated with child improvements.
Methods:
Participants were drawn from two studies of online adaptation of Project ImPACT (Ingersoll & Dvortcsak, 2010). Parents of young children with ASD completed an online, interactive tutorial on Project ImPACT either on their own (n=21) or in combination with twice-weekly therapist assistance (n=21). Families completed lab-based assessments pre- and post- intervention, in addition to completing unstructured parent-child play interactions in the home. Video-recorded play interactions were then rated for parent intervention fidelity, as well as child social communication behaviors using the BOSCC.
Results:
Preliminary analyses were conducted with a subset of the pilot study participants (n = 15). Significant improvement was observed from pre to post on parent fidelity, $t(14) = 4.68$, $p < .01$, $d = 1.20$, and child BOSCC Social Communication (SC) total scores, $t(14)=3.885$, $p < .01$, $d = 1.00$ (Table 1).Â In addition, there was a significant association between improvements in parents' use of elicitation of child initiations and direct language prompting and improvement in child social communication skills on the BOSCC SC Total (Table 2). Additional analyses will confirm these findings in the full sample (n=42), as well as supplement findings using multiple regression to clarify the amount of variance in child BOSCC change scores that are accounted for by changes in the different parent fidelity dimensions.
Conclusions:
These data suggest that parent use of certain strategies, particularly elicitation of initiations and direct teaching of language, are associated with increased child social communication. Other strategies, such as parent responsiveness, parent modeling of language, and parent prompting of play, were not associated with child social communication behavior. However, it is possible that these behaviors support the interaction, and allow for the efficacy of teaching strategies. Further research should investigate potential "active ingredients" of parent-mediated treatments as they relate to child intervention response over time.

207 **109.207** Umbrella Review: Systematic Reviews of Psychosocial Interventions for Children with Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) now affects approximately one in 68 children, making it one of the most prevalent neurodevelopmental disorders of childhood (Center for Disease and Control [CDC], 2016). Although there is no cure for ASD, there is a diverse range of interventions available that are designed to target the core deficits of the disorder and can improve a child's developmental trajectory (CDC, 2016).Â Over the past 20 years there has been an explosion of ASD intervention research, and as such, it is no longer feasible for individuals to read and retain the vast body of available information in this area (Interagency Autism Coordinating Committee, 2012). Indeed, it is an overwhelming and challenging task for physicians, clinicians, teachers, and policy-makers to determine which specific interventions should be recommended for each individual child. In response to this challenge, there has been a rise in production of systematic reviews (SRs). An umbrella review, which involves collating information from multiple SRs, makes it possible to better determine the effectiveness of ASD interventions and will facilitate evidence-informed decision-making.
Objectives: The present study is an umbrella review of SRs of psychosocial interventions for ASD. The review aims to summarize SRs from 2006 to 2016, evaluate their quality, identify predictive factors associated with quality, and determine best practice recommendations for intervention.
Methods: Studies were identified through comprehensive searches of six electronic databases. The search strategy consisted of keywords and medical subject headings for autism and related disorders and various psychosocial interventions. Eligible studies met the following criteria: systematic search description; participants aged 0-12 with a diagnosis of ASD; and review of a psychosocial intervention. The methodological quality of SRs was assessed using the AMSTAR tool (Shea et al., 2007) and descriptive data were extracted.
Results: The comprehensive search resulted in the inclusion of 159 SRs published between 2006 and 2016.Â In terms of participants, 77% of SRs included both preschool and school age children, 12% included only preschool age, and the remaining 11% included only school age. Sixty-five different journals published these SRs. Six dissertations were included. Additional characteristics of the SRs will be summarized descriptively. Evidence tables will be produced to synthesize the clinical findings and recommendations of the SRs. A backward elimination multivariable regression analysis will be conducted post-hoc to examine predictors of the methodological quality of reviews, as measured by the overall score on the AMSTAR. Review characteristics associated with the quality of reviews and several independent variables will be explored in the regression models.
Conclusions: The methodological strength of the SRs included in this umbrella review was greater than those included in Seida and colleagues' (2009) umbrella review, indicating that they are less vulnerable to bias. Further, Seida and colleagues' review found 30 SRs that met eligibility criteria and were published between 1996 and 2007 while the current umbrella review included more than five times as many SRs, indicating that there has indeed been an explosion of SRs focused on ASD interventions in recent years.

208 **109.208** Using Engaging Social Interactions within a Pivotal Response Treatment Framework to Improve Adaptive Communication Skills and Autism Symptom Severity in Toddlers with ASD: Evidence from a Randomized Controlled Trial

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Background:
Extensive research has examined the use of motivating stimuli to facilitate interventions for young children with autism spectrum disorder (ASD). Rewarding a child's communicative attempts via access to a preferred item has been demonstrated to foster expressive and receptive language development and reduce autism symptomatology (Koegel et al., 1987; Koegel et al., 2010). Considering these promising results, recent studies have evaluated if these benefits may be enhanced through the use of engaging social interactions in lieu of items (Vernon, 2014; Vernon et al., 2012; Koegel et al., 2009). Rather than foster developmental efforts through delivery of motivating stimulus items, this intervention encourages social engagement by capitalizing on social activities informed by child sensory preferences. Research suggests that this approach is particularly effective, leading to widespread gains in eye contact, directed positive affect, verbal initiations, and parent-child engagement (Vernon et al., 2012). The present investigation examines preliminary results of an ongoing RCT examining the impact of this social engagement intervention on language development and amelioration of autism symptoms.
Objectives: This study's objective was to investigate the impact of using embedded social interactions within a Pivotal Response Treatment intervention framework to improve the language skills and autism symptom severity of young children with ASD.
Methods: 19 toddlers with ASD, ages 18-48 months, participated in an ongoing randomized controlled trial. Participants in the immediate treatment condition received 6 months of a social engagement intervention in which language was reinforced with access to a motivating social exchange derived from each child's existing, but non-social preferred activities. A comprehensive battery of assessments was administered to participants at pre- and post-intervention, including measures of adaptive functioning (the Vineland Adaptive Behavior Scales, Second Edition) and autism symptom severity (the Autism Diagnostic Observation Schedule, Second Edition). A multivariate analysis of variance (MANOVA) was conducted to identify changes in language abilities and autism symptoms across groups.
Results: With the use of Wilk's criterion, multivariate analysis of Vineland scores revealed that the treatment group exhibited significantly greater gains in overall communication abilities in comparison to the control group: $F(1, 15) = 6.42$, $p=.023$. More specifically, the intervention was associated with significant improvement in participants' receptive language skills when compared to the control group: $F(1, 15)= 5.65$, $p=.031$. While expressive language scores exhibited a positive trend within the intervention group that was not present in the control group, this result was not yet statistically significant given the preliminary nature of the data and small n: $F(1, 15)= 2.92$, $p=.108$. Multivariate analysis of ADOS total scores revealed that participants in the treatment group exhibited a significantly greater improvement in autism symptoms than the control group: $F(1, 17)= 5.27$, $p=.035$.
Conclusions: These results support the benefits of using an embedded social interaction modification to established PRT procedures to improve the communication skills and autism symptoms of toddlers with ASD. The positive growth trend seen in the data suggest that the adaptive language skills of children with ASD move within the proximity of typically-developing peers following participation in this project.

209 **109.209** Visual Pattern As a Secondary 'Biologically-Oriented' Outcome in the Field of Early Intervention of the Autism Spectrum Disorder: Can the Eye-Tracker Provide Useful Suggestions ?

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Background: Eye tracking has the potential to characterize autism spectrum disorder at a unique intermediate level, with links 'down' to underlying neurocognitive networks, as well as 'up' to everyday function and dysfunction. Because it is non-invasive and does not require advanced motor responses or language, eye tracking is particularly important for the study of young children and infants (Falck-Ytter et al., 2013).
Objectives: A previously published studies indicated that the early intervention resulted in gains in developmental level, language and adaptive behavior of children with autism spectrum disorder. This work describes a secondary 'biologically-oriented' outcome: the visual pattern studied through eye-tracking.
Methods: Twenty 24 to 30 month old children at their first diagnosis of autism spectrum disorder were recruited and their visual pattern, in addition to the standard clinical protocol, was studied at T0 (time of the first diagnosis) and at T1 after 6 months of intervention. The eye-tracking tasks consisted in the presentation of short video sequences involving responding (figure 'a') and two initiating JA tasks (JA1 figure 'b' and JA2 figure 'c'). Gaze accuracy, transitions and fixations were analyzed. Age-matched typical children were also compared at T0 and T1.
Results: In responding JA task children with ASD improved their engagement with target object showing an increased fixation at T1 compared to T0 (p=.02). No significant difference with typical children was found at T0 while a slightly increase in looking at target was discover at T1 (p=.048). In initiating JA1 children with ASD significantly improved their ability of disengage and explore space: increased transitions from non-target object to target object (p=.01), tended to look more to non-target object (p=.06) and decreased fixations at face (p=.01). At T1 their still made more transitions at the target object compared to the non-target one (p=.02) respect to typical children (higher transitions score) while they did not show any more decreased attention at non-target object. As regards IJA2 ASD children did non show significantly improvement in visual pattern and they still made more transitions then typicals between target object and face. From a clinical point of view, at T1 children showed a significantly improved in terms of ADOS-2 comparison score (CS). Also developmental level, language and adaptive behavior showed significant gains.
Conclusions: For our knowledge this was the first trial that used the eye-tracking as out come measure to demonstrate that early intervention was associated with progressive normalized visual pattern and with improvements in social behavior in young children with autism spectrum disorder.

210 **109.210** Group-Based Interventions for Parents of Children with ASD: Impact on Psychological and Physiological Outcomes

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Background: Parents of children with autism spectrum disorder (ASD) report exceptionally high levels of stress as compared to their counterparts, and parental stress exerts bidirectional effects on child outcomes. Caregiving stress likely results in poor health outcomes for parents, but we know very little about parental objective health profiles, given that most intervention studies rely on parental self-report outcomes. Parent-focused interventions (e.g., psychoeducation, behavioral education, mind-body interventions, social support) in ASD have been tested and demonstrated as helpful in addressing child outcomes, but the data on parent outcomes are equivocal.
Objectives: Evaluate the feasibility and preliminary efficacy of two group-based interventions (i.e., psychoeducation and mindfulness) for parents of children with ASD, with a focus on psychological and physiological outcomes.
Methods: Twenty-two parents of children with ASD (17 completers) with high baseline parental stress (i.e., above the 90thpercentile) were enrolled in a pilot, randomized clinical trial on parent-focused interventions. Participants were randomized to 8 weeks of either a group psychoeducation program (GPEP) or a group mindfulness-based intervention (MBI). Parental self-report on psychological outcomes (parental stress, caregiver strain, perceived health) and physiological health outcomes were collected at baseline and post-treatment. Physiological/clinical outcomes were assessed in a laboratory setting (heart rate variability, blood pressure) and in the participant's home environment (sleep, via actigraphy).
Results: Regarding feasibility outcomes, we met recruitment goals and had approximately 21% attrition, which is comparable to other parent training programs. Post-treatment, parents in GPEP demonstrated significant reductions in total stress (p=.04) and on the Parental Distress (p=.05) and Difficult Child Interactions (p>.01) domains. Parents in MBI improved only on the Difficult Child domain (p=.05). Between-group comparisons revealed that GPEP parents showed greater change post-treatment than MBI for parental stress (p>.01). In contrast, the MBI group showed significant improvement in perceived physical and emotional health (p=.02), whereas the GPEP group showed no change. Neither group demonstrated change in caregiver strain. No differences were observed in either group on physiological or clinical health outcomes.
Conclusions: Parent-focused interventions that are delivered in group formats and that are evaluated via multiple approaches to outcomes are important, but significantly understudied in ASD. The current study preliminary supports the feasibility of adapting individual intervention into group-based treatments and collecting objective data on functional and clinical health outcomes. In this small pilot sample, both psychoeducation and mindfulness effectively addressed different aspects of parental stress and perceived health. Along with previous research, this highlights the importance of including mediator and moderator analyses in parent interventions to identify what factors might influence treatment response. In this sample, no changes in physiological outcomes were observed, suggesting that parent perceptions of improved stress and health may not necessarily translate into change in objective health outcomes. This was a very small pilot sample, so the results are not conclusive. However, they do suggest the feasibility and importance of continuing parent-focused interventions that considers multiple outcomes.

211 **109.211** Child Outcomes and Behavioral Predictors of Treatment Response for Pivotal Response Treatment

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Background: Pivotal Response Treatment (PRT) is an evidence-based naturalistic behavioral intervention which is traditionally delivered via a parent training model. Support for its use in improving language abilities has historically come from single-case studies using primarily behavioral observation measures. There is a critical need for examination of outcomes from larger samples and from objective measures which can be more easily compared across trials and to normative developmental trajectories. Furthermore, identification of behavioral factors which predict treatment response will be essential for selecting the best treatment for an individual child.
Objectives: This presentation will review outcomes from a randomized controlled trial comparing a Delayed Treatment Group (DTG) to a PRT package treatment (PRT-P) which combines parent training with clinician-delivered in-home treatment. We hypothesize that the addition of clinician-delivered early intervention may help boost child language development while parents are learning the PRT techniques. Our aim is to highlight new data demonstrating how standardized measures of language and cognitive abilities can be used to assess and predict treatment response in clinical trials.
Methods: Participants include 48 children with ASD and significant language delay, ages 2-5 years. Children were randomly assigned to DTG or PRT-P, which involved weekly parent training and 10 hours per week of in-home therapist-delivered treatment for 3 months, followed by a less-intensive phase with 5 hours per week of in-home treatment and monthly parent training sessions. Dependent measures included Clinical Global Impression Improvement (CGI-I) ratings by trained raters blinded to treatment condition, as well as standardized parent questionnaires such as the MacArthur-Bates Communicative Development Inventories (CDI), as well as structured behavioral observations.
Results: Examination of changes with PRT-P reveal that children in the active group acquired greater vocabulary as evidenced by an average gain of 137 words between baseline (*M*=134 ± 113.5) and post treatment (*M*=271 ± 205) on the CDI, which was significantly greater than changes observed in the DTG (F=6.089; df(1:34); p=0.019). CGI-I ratings indicate that the PRT-P group is showing more improvement in communication compared to controls (X^2(3, N=40)= 17.50; p=0.001).Â Specifically, 4 children were rated as very much improved (0 in DTG), 10 children rated as much improved (2 in DTG), 4 children rated as minimally improved (14 in DTG) and one child rated "no change" (5 in DTG). In addition, greater change between baseline and post-treatment on the CDI was correlated with baseline Mullen Early Learning Composite (R: 0.716; p=0.009) and with Mullen nonverbal skills (R: 0.555; p=0.049) suggesting that better performance on tests of early cognitive skills may predict response to PRT.
Conclusions: These data suggest that the PRT package approach shows promise for addressing communication deficits associated with ASD. Potential benefits and challenges of a combined parent training and clinician-delivered early intervention approach will be discussed, with a focus on factors which may predict an individual child's response to treatment and aid clinicians in better personalizing care.

212 **109.212** Treatment Adherence and Dose As Predictors of Child Language Outcomes in Pivotal Response Group Parent Training

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Background: Behavioral interventions are robustly supported in ASD treatment, including those that are parent-administered. Previous research supports that group parent training in Pivotal Response Treatment (PRTG) results in gains in child language ability (Hardan et al., 2015). There remains a need, however, for better understanding of the relationship between parent fidelity of treatment implementation, dose of treatment, and child outcomes.
Objectives: To evaluate relationships between adherence to implementation, therapy dose, and child language outcomes from a randomized controlled trial of PRTG.
Methods: Participants included parents and their children, ages 2-6 years, with diagnoses of ASD and significant language delay. In the RCT, 53 participants were randomly assigned to either PRTG or a parent psychoeducation group (PEG). PRTG consisted of 12 weeks of parent training in the delivery of pivotal response therapy targeting language development. Parent adherence to PRTG implementation (defined as % fidelity to pre-defined therapy characteristics achieved) and dose (defined as the number of parent-implemented child learning opportunities) were coded at baseline, mid-point (week 6), and endpoint (week 12). The dependent measure was the number of child utterances at week 12 based on a structured laboratory observation. Linear regression and structural mediational models were used to evaluate relationships between PRTG treatment, parent fidelity, child learning opportunities, and child utterances.
Results: PRTG treatment substantially increased both fidelity and learning opportunities by week 6. At week 12, child learning opportunities was a significant independent predictor of child utterances, even after accounting for non-verbal ability. However, the relationship between parent fidelity and child learning opportunities was substantial (r=.66) and this shared variance was the biggest predictor of child utterances. Mediational models indicated that PRTG treatment resulted in early and ongoing improvements in parent fidelity, which lead to increases in the number of child learning opportunities, which, in turn, resulted in increased child utterances.
Conclusions: The present findings indicated the attention PRTG treatment provides leads to early and ongoing improvements in the quality of therapy provided by parents. These improvements in therapy quality coincide with improvements in the number of learning opportunities and together these enhancements in treatment adherence and dose improve child language outcomes. Results highlight the importance of therapy adherence and dose as crucial, consistent with findings from early intensive behavioral intervention studies. Parent-based behavioral intervention strategies should continue to emphasize treatment adherence throughout the delivery of treatment, as this is an important determinant of success via increasing the number of child learning opportunities. Additional research is needed to establish appropriate dosing of parent training to maximize child outcomes, but the present results suggest that 12 weeks is a useful lower bound.

213 **109.213** Structural Neuroimaging Predictors of Benefits from Pivotal Response Treatment

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Background: Autism spectrum disorder (ASD) is a heterogeneous disorder and several neurobiologic measures have been examined to identify potential subgroups, with limited success thus far. Applying neuroimaging methodologies to identify prognostic markers or indicators of treatment response may be an alternative approach to address this heterogeneity. To date, no biomarker of treatment response has been identified for any biological or behavioral intervention in autism. Additionally, there is a growing need for innovative, efficient, cost-effective treatment models guided by biological markers of treatment response to optimize results and longterm outcome. This is particularly true for very young children with ASD when the brain is most plastic and time should not be wasted in implementing treatments that might not be beneficial.
Objectives: The goal of this investigation is to use a hypothesis-generating approach and apply multimodal imaging techniques to help identify biomarkers of treatment response. In this investigation, we aim at applying structural magnetic resonance imaging (MRI) and diffusion tensor imaging (DTI) to identify biomarkers of pivotal response training (PRT) treatment response. The development of biosignatures of treatment response is critical and the present study is the first step in providing evidence supporting the possibility of identifying biomarkers to predict response to behaviorally and biologically--based treatments.
Methods: The PRT intervention consisted of teaching parents behavioral techniques to facilitate language development. PRT training lasted at least 12 consecutive weeks with one session per week. Sessions included in vivo coaching of parent implementation of PRT techniques with their child, as well as review and feedback on videos of parents practicing PRT at home. Objective and subjective outcome measures were obtained at baseline and at the end of treatment. High resolution anatomical MRI and DTI scans are being obtained on children with ASD before and after their participation in PRT. Correlations between neuroimaging measures (volume and surface) and fractional anisotropy (FA)) in language areas (e.g. superior longitudinal fasciculus(SLF)) and changes in outcome measures were examined.
Results: Eighteen children with ASD have participated in this study to date. Anatomical MRI and DTI scans have been obtained on all individuals at baseline (prior to treatment). Five followup scans (post treatment) have successfullyÂ been collected.Â NeuroimagingÂ andÂ treatmentÂ dataÂ areÂ availableÂ on 8Â participantsÂ asÂ theÂ additionalÂ scansÂ andÂ behavioral informationÂ areÂ beingÂ processed.Â A relationship between the volume (n=8; r_s= -0.81, p= 0.015) and surface area (n=8; r_s= -0.82, p= 0.013) of the inferior frontal gyrus, which contains Broca's area, were significantly associated with changes in the number of utterances as assessed during structured laboratory observation (Figure 1). Cortical thickness was also associated with expressive communication (n=7; r_s= -0.88, p= 0.008) as assessed with PLS-5. Associations between FA in the SLF and changes in several language measures were observed including the number of utterances during structured laboratory observation and number of words produced out of 396 on the MacArthurBates Communicative Development Inventories.
Conclusions: Preliminary findings from this pilot study suggest that neuroimaging measures are potentially useful as predictors of treatment response. Additional analyses will be completed as more data become available. We will discuss these findings and highlight the advantages and challenges of using neuroimaging information in clinic trials to assess treatment response and biologic changes due to the intervention.

214 **109.214** Neural Predictors and Neural Pathway of Response to Pivotal Response Treatment in Young Children with Autism

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Background: Autism Spectrum Disorders (ASD) are common yet complex neurodevelopmental disorders, characterized by social, communication, and behavioral deficits. Behavioral interventions for young children with ASD have shown favorable results; however, significant obstacles exists in the development of precision medicine in ASD. Specifically, it remains largely unclear (a) what sensitive, objective pretreatment neurobiological markers can accurately forecast the response to treatment, and (b) what neural pathways mediate the treatment outcome. It is important to be able to predict or stratify subgroups of young children likely to respond to specific treatments because early childhood provides a sensitive window of opportunity for intervention, while unsuccessful intervention is costly to children, families, and society. It is also important to understand the neural mechanism of treatment responses because the pathways may provide a neural target for concurrent intervention to boost treatment effects during the course of treatment.
Objectives: To develop pretreatment neurobiological markers that can predict the response to an evidence-based behavioral treatment—Pivotal Response Treatment (PRT)—in young children with autism, and to examine the neural mechanism underlying treatment effects.
Methods: In a sample (*N*=20; 7 girls, 13 boys) of young (*M* age=5.90 years, *SD*=1.07), cognitively-able (*M* FSIQ=103.45, *SD*=17.03) children with ASD, who participated in a 16-week trial of PRT, we measured the change in autism symptom severity by modeling the delta change scores (that is, post minus pre) of the parent-report Social Responsiveness Scale (SRS) total raw scores, while our study participants viewed neuroimaging stimuli depicting point light displays of coherent biological (BIO) or scrambled (SCRAM) motion in a 3T scanner within 1 week before and after PRT. fMRI analyses were conducted with mixed-effects modeling and the results were thresholded at *Z*>2.33 (voxel) and *p*<.05 (cluster), while gender was controlled for as a covariate of no interest.
Results: First, with respect to neural predictors, we found that greater reduction in autism symptom severity from pretreatment to post-treatment was linearly associated with greater pretreatment levels of activity in response to biological vs. scrambled motion in the neural circuits that support social information processing (superior temporal sulcus, fusiform gyrus, amygdala, inferior parietal cortex, and superior parietal lobule) and social motivation/reward (orbitofrontal cortex, insula, putamen, pallidum, and ventral striatum) (**Figure 1A**). The predictive value of our findings for individual children with ASD was supported by a multivariate pattern analysis with cross validation. Second, with respect to neural pathways, we found that greater reduction in autism symptom severity was linearly associated with increase in activity in response to biological vs. scrambled motion in the action observation network (inferior parietal lobule, parietal operculum cortex, supplementary and pre-supplementary cortices located on the medial surface) (**Figure 1B**).
Conclusions: Predicting who will respond to a particular treatment for ASD and advancing the knowledge of neural pathways of treatment outcomes, the current findings provide key neural bases of behavioral response to treatment in young children with ASD. The implications of the findings are far reaching and should greatly accelerate progress toward more precise and effective treatments for core deficits in ASD.

215 **109.215** Outcomes for Children Receiving the Early Start Denver Model in a Mainstream Versus Autism-Specific Setting: A Pilot Randomized Controlled Trial

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Background: Â The U.N. Convention on the Rights of Persons with Disabilities (United Nations, 2006) has articulated a human right for access to early intervention for young children with disabilities, which should be provided in the least restrictive environment suitable to meet children's needs, including consistent opportunities for interaction with typically developing peers. To date, there is little scientific research testing the benefits and disadvantages of providing early intervention within mainstream versus autism-specific settings. The aim in our study is to address this gap.
Objectives: Â To examine the outcomes of an evidence based early intervention program provided in a community childcare center for children in an autism versus mainstream setting.
Methods: We conducted a sequential multiple assignment randomized trial (SMART RCT) involving 32 toddlers with ASD. Half participants were randomly assigned to receiving an evidence-based early intervention program (the Early Start Denver Model) in a playroom that only includes children with ASD (autism-specific setting group), and the other half (social inclusion group) received the same intervention within a mainstream setting with neurotypical peers. Participants' communication, adaptive behaviour and autism symptoms was measured at baseline and after 1 year post-intervention.
Results: Preliminary analyses including 8 children in each group revealed that both groups equally improved in their communication from baseline to post-treatment, as assessed through the Mullen Scales (Repeated Measures ANOVA, $F(1, 14) = 8.3$, $p = .01$, $\eta_p2 = .37$), and experienced a reduction of ASD symptoms, as assessed through the Social Communication Questionnaire (($F(1, 14) = 9.73$, $p < .01$, $\eta_p2 = .40$). While both groups significantly improved in their adaptive behaviour as assessed through the Vineland (($F(1, 14) = 12.46$, $p < .005$, $\eta_p2 = .47$), there was a trend suggesting superior gains in the social inclusion group (($F(1, 14) = 3.11$, $p = .09$, $\eta_p2 = .18$).
Conclusions: Preliminary results suggest that receiving early intervention in a mainstream setting has the potential to be equally beneficial, and potentially more beneficial, than receiving the same intervention in an autism-specific setting. **Â**

216 **109.216** Preschool Early Intervention Outcomes in Different Community Based Settings

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Background: Despite the requirement in the United States to provide free and appropriate public education for young children with ASD in the least restrictive environment suitable for their needs, there is little research comparing the impact of settings of varying restrictiveness where interventions are delivered (Parsons et al., 2011). Consistent opportunities to interact with typically developing peers often are a recommended practice for young children with ASD (e.g., Koegel et al., 2009). Studies of inclusive preschool programs for children with ASD suggest that preschoolers with ASD can make gains in cognitive, academic, language, functional and social skills when placed with their typically developing peers. However, there is debate as to the appropriateness of inclusive settings for children with ASD. Most research to date of early interventions programs has investigated interventions delivered in more segregated settings (home and clinic based individual services or ASD specific classrooms). These settings do not routinely offer opportunities to interact with neurotypical peers, and have not compared inclusive to non-inclusive settings. However recent research has suggested that inclusive preschool intervention may be particularly beneficial for some children with ASD (Nahmias et al., 2012).
Objectives: To examine the main effects of receiving preschool early intervention in one of four educational settings that vary in their level of restrictiveness (Home, ASD-only, Mixed disability, or Inclusion).
Methods: Participants are 115 children with ASD (Mean age = 45.5 months, 80.9% Male, 46.1% Black/African American) that receive intervention services through a public preschool early intervention system. Participants are assessed at study enrollment and 9 months later with a standardized developmental assessment of cognitive and language skills (the Mullen Scales of Early Learning). Parents and teachers also completed questionnaires assessing the child's adaptive behavior and social skills (Adaptive Behavior Assessment System- 2nd Edition; Social Skills Improvement System). Data collection and analysis are ongoing. Preliminary results based on 60 participants are presented below, using repeated measures ANCOVA to assess for changes over time by setting, controlling for baseline differences.
Results: Based on adjusted analyses, groups did not differ in their improvement over time in their cognitive, expressive or receptive language, adaptive behavior, or social skills (all *ps* ³ .3, η_p2s £ .08).
Conclusions: These results suggest preschoolers with ASD on average may make equivalent gains across different types of early intervention settings. These findings provide substance to the argument that inclusive settings are well suited for children with ASD, suggested that children can do as well in inclusive settings as segregated settings. Moderator analyses are planned to assess whether there are child characteristics associated with increased benefit from attending a particular type of setting.

217 **109.217** Child and Parental Factors Associated with Preschool Placement in an Urban Early Intervention Setting

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Background: Â Federal legislation requires that children with autism be placed in the least restrictive environment appropriate to their needs. Little research has been conducted on the predictors of where children with autism are placed in their early intervention placements. Child and family characteristics such as child age, social skills and Verbal IQ, as well as family income, have been found to predict educational placements in elementary schools; it is not clear if these same factors predict placements in preschools (Lauderdale-Littin, Howell & Blacher, 2013; Harris & Handleman, 2000). Initial findings from qualitative research indicate that inclusive vs. segregated placements is driven by parents' advocacy skills; however no quantitative studies have examined this question (Lalvani, 2012). Understanding of these factors in relation to early intervention settings that vary in their restrictiveness is the critical first step to supporting family and provider partnerships for early intervention planning in the community.
Objectives: Â To examine parent and child characteristics associated with placement in four early intervention settings (autism only, mixed disability, inclusion and home-based services).
Methods: Â Parents and teachers of 77 preschool aged children with ASD receiving early intervention services in Philadelphia (3–5 years, 80% male, 56% African-American) completed questionnaires about children's social skills and problem behaviors (Social Skills Improvement System Rating Scales),Â adaptive behaviors (Adaptive Behavior Assessment System 2nd Edition), cognitive and language development (Mullen Scales of Early Learning; MSEL). Parents also answered questions from the Early Intervention Placement Preference Survey about their perceived advocacy skills and their opinions of the relative benefits of different early intervention placements.
Results:
Data collection and analyses are ongoing. Preliminary analyses show that children in autism-only classrooms had lower adaptive behaviors than those in inclusion or home-based settings (F (3,85)=4.99, *p*=.003). There were no significant differences in problem behaviors and social skills among children in different setting types. Children in inclusive settings had greater expressive language (F (3,99)=4.36, *p*=.006) and receptive language (F(3, 99)=3.62, *p*=.02) than those in mixed disability or autism only settings. Parents of children in inclusion settings were more likely than parents of children in other settings to report that they rely on experts for placement advice (X^2 (12, 77) =23.66, p<.05). This 'expert reliance' was also marginally correlated with whether the parent's placement preference ever matched their actual placement setting (r(74)=.16, p=.09).
Conclusions: Â Results suggest greater adaptive behaviors and language skills are associated with being placed in inclusion preschool settings, which indicates that these child factors may be considered by professionals when placement decisions are made. Results also suggest that parents of children in inclusive settings consult providers in placement decision making more than parents of children in other settings. Though directionality cannot be determined from the current research design, this provides a future research direction to explore. Further analyses will include an extended sample as well as regression analyses to examine specific predictors for placement.

218 **109.218** Impact of Challenging Behavior, Inhibition, and Emotion Regulation Skills on Developmental Outcomes in Preschoolers with Autism

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Background: Three quarters of school-aged children with ASD present with emotional dysregulation and almost two thirds present with challenging behaviors. Decades of research has shown strong associations between emotional dysregulation and challenging behaviors; these behaviors affect academic outcomes in typically developing children and predict teacher burnout. Their effect in academic outcomes in preschoolers with ASD is not yet known.
Objectives: To examine the impact of challenging behaviors (i.e. aggression, bullying) and emotional regulation skills on developmental outcomes in children with ASD
Methods: A total of 44 preschoolers (3-5 years) with ASD receiving community based intervention services participated in the study, data on the first 20 are presented here (data collection is ongoing). Children were given a standardized developmental assessment (the Mullen Scales of Early Learning; Mullen) at baseline and then 9 months later. Teachers completed questionnaires assessing challenging behaviors (the Social Skills Improvement System: Problem Behaviors Scale) and emotional regulation (the Behavior Rating Inventory of Executive Function: Emotional Control scale), and children completed a novel task of "hot" (socio-affective) executive function skills, the Tongue Task. This task measured the time in seconds for which children resisted eating a candy, thus tapping inhibition skills with a rewarding stimulus that should invoke impulsive behavior, which may be relevant for emotion regulation capacity. Multiple linear regression analyses controlling for age and sex were conducted to examine the impact of emotion regulation and hot inhibition on Mullen developmental quotient (DQ) change scores over 9 months.
Results: Â In an adjusted analysis, only teacher-rated emotion regulation was statistically significantly associated with Mullen DQ change scores, *b*Â = .38,Â *t*(17) = 2.34,Â *p*= .03, with more difficulties in emotion regulation at baseline associated with *greater* cognitive and language gains. Hot Inhibition skills were marginally associated with developmental gains, *b* = .44, *t*(17) = 1.91, *p*= .07, such that stronger hot inhibition skills were also associated with greater gains in DQ. Teacher-rated emotion regulation was unrelated to hot inhibition skills (*r*(23) = .10, *p*= .64). Teacher-rated challenging behaviors did not predict developmental outcomes (*p*s > .28).
Conclusions: Results suggest that emotion regulation and hot inhibition skills have parseable moderation effects on cognitive outcomes in preschoolers with autism, with an unexpected negative relationship between emotion regulation and developmental outcomes. As expected, higher hot inhibition skills were related to greater developmental gains which fits with current knowledge on these as prerequisite skills for learning. This pattern of findings is indicative of a potential bootstrapping effect that hot inhibition skills may have on emotion regulation difficulties, to be tested in future research designs. Contrary to research in typical development, in this study challenging behavior did not impact outcomes. Results will be updated to include the final sample.

Poster Session
110 - Social Cognition and Social Behavior I
12:00 PM - 1:40 PM - Golden Gate Ballroom

219 **110.219** Parental Attitudes Towards Touch Screen Device Use in Children with an Autism Spectrum Disorder.

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Background:
Touch screen technology has increased significantly in usage amongst children and adults. Since 2012, families who own a smart phone, tablet and laptop have increased from 26% to 56% (Deloitte Media Consumer Survey, 2016). Parental and educational forums reveal children with Autism Spectrum Disorders (ASD) are amongst the high percentage of touch-screen device users. Despite the growing increase in touch screen use, it is unclear whether children with an ASD are benefitting from using a touch-screen device, e.g. using a touch-screen for socialising, or whether using a touch-screen is having any negative impact on their development, e.g. social isolation.
Mixed reviews on parent forums have indicated there may be a difference in opinion between parents of children with an ASD compared to parents of children who are TD. Therefore, suggesting parents of children with an ASD may be more accustomed to different apps and find more benefits to using touch screen devices that go unnoticed in parents of TD children.
Objectives:
1) Are there differences in attitudes and feelings (e.g. guilt) toward touch screen device use in parents of children with an ASD, compared to parents of children who are typically developing (TD)? If so, what are the nature of these differences?
2)Do parents find touch screen devices are facilitating or interfering with their child's development, such as their social skills?
Methods:
Data were collected from a survey that was advertised through Swinburne University, located in Melbourne, Australia. Situated in the university is a child research centre called the 'BabyLab', and the survey was advertised on the BabyLab webpage, Facebook page and shared by parents through mother and parent- group networks. Parents of children who have an ASD and parents of children who were TD aged between 2-12 years old were invited to participate. Data was collected in Australia, Canada, the UK and the U.S. A total of 203 parents have participated to date.
Results:
Parents of children with an ASD (n=111) reported touch screen devices were helpful in facilitating social, emotional and friendship skills, compared to parents of children who were TD (n=92), and did not report such benefits. A significant effect was found in parents of children with an ASD, who reported feeling less guilt about their child's use of a touch-screen device, when they reported the touch-screen device facilitated with their child's social, emotional, and friendship skills p <.05.
Conclusions:
The data from this survey indicates there are differences in attitudes from parents who have a child with an ASD compared to parents who have a child who is TD and their use of touch-screen devices. These data are important to help guide us in what areas children with an ASD are either benefitting from the use of touch-screen devices, or what could be problematic. With the increasing exposure of touch-screens it is beneficial for parents and practitioners to evaluate how children can be best supported with using such devices considering their high usage in the ASD population.

220 **110.220** Parental and Teacher Reports of Social Skills and Problem Behaviours in Children with Autism Spectrum Disorder

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Background: Cross-informant literature suggests that parents and teachers provide unique information on children's social competencies across settings. However, there is also considerable evidence to indicates that these informants often differ in their reports of child behaviours. Parents consistently report more problem behaviours at home in comparisons with teachers, both informants report similar social skills (Achenbach & McConaughy, 1987)
Objectives: This study compared parent (*n*=46) and teacher (*n*=44) ratings of social skills, problem behaviours and peer interaction in a sample of school-aged children with an Autism Spectrum Disorder (ASD). A second objective was to identify which social areas children are reportedly strongest and weakest according to parents and teachers.
Methods: Parents and teachers completed the Social Skills Improvement System (SSIS) to obtain a cross-informant perspective of positive and negative social behaviours. The Penn Interactive Peer Play Scale (PIPPS) was also completed to assess three dimensions of play across settings 'play interaction', 'play disconnection' and 'play disruption'.
Results: As expected, parents reported a higher occurrence of maladaptive behaviours in the home environment. Parent and teacher ratings of social skills were simiar across settings as expected. Parents and teachers also converged on two dimensions of the PIPPS: 'play interaction' and 'play disruption'. A significant difference in reports of 'play disconnection' was evident with parents reporting higher disconnection. Communication was identified as a social strength by both informants. Despite differences in the frequency of problem behaviours, informants agreed that hyperactivity/inattention and externalizing were the most common and challenging behaviours.
Conclusions: Understanding social weaknesses provides a benchmark for tailoring social skills interventions to support these areas of difficulty. Addressing challenging behaviours at school age may minimise subsequent disruption on later development and social engagement during adolescents and adulthood.

221 **110.221** Patterns of Visual Engagement Identify Distinct Subgroups of School-Age Children with ASD

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Background: The vast heterogeneity in Autism Spectrum Disorder (ASD) is an obstacle to advancements in identifying and treating causes of the disorder. Eye-tracking measures of atypical visual engagement with the social world—a quantitative metric that captures a defining symptom of the condition – provides a promising means for deriving more homogeneous subgroups (Rice et al., 2012; Campbell et al., 2014). Parsing heterogeneity in ASD by measuring visual scanning during dynamic social scenes may contribute to the identification of intermediate phenotypes for genetics research, and to the development of interventions optimized for individual children.
Objectives: To examine: (1) whether subgroups of children with ASD can be reliably identified based on patterns of variability in social visual engagement; and (2) whether the subgroups differ on standardized measures of social disability.
Methods: A heterogeneous sample of children with ASD (n=178, age=10.51(3.19)) watched age-appropriate, socially-relevant videos while eye-tracking data were collected. Percent fixation on eyes, mouth, body, and object regions was calculated for each child. The Hopkins index was used to assess whether clusters are reliably identifiable by variability in visual scanning. Unsupervised statistical learning methods, including Principal Components Analysis (PCA) and hierarchical clustering, were utilized to visualize and identify clusters of different visual fixation patterns. Analyses were performed on scaled data and inter-observation distances were calculated via Euclidean distances. A three-cluster solution was achieved through hierarchical clustering of fixations to eyes, mouth, body, and object in each participant pair.
Results: The Hopkins Index indicated the clustering tendency as appropriate (0.16<0.5). PCA and hierarchical clustering analyses identified three clusters of children with ASD (Figures 1a & 2b). As expected, ANOVA and post-hoc Tukey analyses revealed significantly different fixation patterns between clusters (Figures1a,2b), with Cluster 1 fixating more on eyes, Cluster 2 on mouths, and Cluster 3 on objects. Children in Cluster 1 had lower Vineland communication scores (p=0.051) compared to Cluster 2, suggesting that higher eye-looking may not be associated with greater adaptive skills in this subgroup of children. Consistent with previous reports that higher mouth fixation is associated with lower social disability (Rice et al., 2012) children in Cluster 2 had significantly lower ADOS symptom severity (p=0.051) than those in Cluster 3, and higher Vineland communication scores (p=0.051) than those in Cluster 1 (Figure 2b). Finally, children in Cluster 3 had higher ADOS symptom severity scores compared to those in Clusters 1 (p=0.098) and 2 (p=0.051), suggesting that high levels of object fixation are associated with greater social disability. Cluster 3 also had a significantly higher proportion of males (p=0.024) than Clusters 1 and 2 (Figure 2a).
Conclusions: Results demonstrate that variability in visual engagement during viewing of dynamic social scenes can be used to identify more homogeneous subgroups of children with ASD. These subgroups displayed distinct patterns of visual attention, and varied by gender and measures of social ability. Future analyses will examine whether the social adaptive value of visual scanning patterns vary for different subgroups of children with ASD, a critical step towards creating interventions optimized to the individual's learning style.

222 **110.222** Perceptions and Experiences of Friendship and Loneliness in Adolescent Males with High Cognitive Ability and Autism Spectrum Disorder

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Background: Many high-functioning individuals with autism spectrum disorder (ASD) have a desire for friendships, despite social deficits. In fact, these individuals experience loneliness in adolescence and into adulthood. While youth with high-functioning ASD have demonstrated less mature friendship qualities and motivation for friendship behaviors, no previous research has identified the experiences of loneliness, the friendship qualities and the motivation for friendship behaviors, along with the social deficits of youth with high cognitive ability (IQ > 120) and ASD. These twice exceptional youth have unique experiences, given their high intelligence, which may or may not facilitate their social-emotional functioning.
Objectives: This study identified the perceptions and experiences of friendships and loneliness in twice exceptional adolescent males with high cognitive ability and ASD. Additionally, this study described how friendship quality, motivation for friends, social skills, and intelligence may influence loneliness in these twice exceptional males.
Methods: This study employed a multiple case study design with 10 twice-exceptional adolescent males, ages 13-9 to 18-11, who have high cognitive ability (Full Scale IQ, Verbal IQ, or Perceptual IQ >120) and ASD. Adolescent, parent, and teacher interviews were completed, transcribed, and analyzed using Consensual Qualitative Research (CQR).
Results: Results describe friendship quality for these youth, with particular contributions to current understanding of companionship, security, help, closeness and balance. Findings inform friendship motivation, as well, and etiologies of amotivation are documented. Results indicate positive and negative influences of high intelligence on interpersonal functioning, and immaturity and symptoms of rigidity affecting friendships, as well. Pathway analyses reveal twice-exceptional youth with insecure friendships experience loneliness and introjected motivation for friendships, along with increase in peer dyadic relationships and decrease in loneliness. Those with insecure friendships and perseverative interest in peers also present with suicidal ideation and/or attempts.
Conclusions: Future research should expand the use of individual therapies (i.e., cognitive behavioral therapy for depression) for these twice-exceptional teens, particularly in middle school, with modifications to accommodate difficulties with perseveration on negative emotions, as well as explore coping strategies of engaging with fictional characters when lonely.

223 **110.223** Phenotype and Eye Tracking Heritability in Twin Pairs

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Background:
Studying twin pairs can give valuable insight into genetic and environmental factors contributing to Autism Spectrum Disorder (ASD). Studies examining twins indicate about a 70-95% percent concordance rate for autism in monozygotic twins and about 30 percent concordance for dizygotic, same-sex twins (e.g., Hallmayer et al., 2011; Nordenbaek et al., 2014). In addition, symptom severity within twin pairs, based on parent questionnaires, concluded that extreme social and repetitive behavior symptoms of autism had high heritability (Frazier et al., 2014). Quantitative measures for reciprocal social behavior also indicate greater trait concordance for monozygotic twins than dizygotic twins (Marrus et al., 2015).
Objectives:
To investigate in a sample of twins, referred for diagnostic evaluation, whether there is high concordance in directly assessed, phenotypic profiles of monozygotic and dizygotic toddlers.
Methods:
Participants included 8 sets of twins ranging in age from 16 to 35 months (mean=28.75 months; SD=6.57) including 3 sets of monozygotic (MZ) twins and 5 sets of dizygotic (DZ) twins. Participants received a clinical evaluation and underwent an eye tracking session through a research study at the Marcus Autism Center. Diagnostic assessments included the *Mullen Scales of Early Learning and the Autism Diagnostic Observation Schedule, 2nd Edition* (ADOS-2) and a medical/developmental history was collected.
Results:
Of the MZ twins, all pairs were diagnosed with ASD. Of the DZ twins, 3 pairs were diagnosed with ASD, 1 pair with language delay, and one where one twin had no clinical features and the other had a subthreshold developmental delay. There was fair agreement on age of parental reported first concerns for MZ and DZ twins (ICC = 0.49; 0.38, respectively). Strong to almost perfect intraclass agreements, for both MZ and DZ twins on the ADOS-2 were found across total scores (ICC = 0.93; 0.91, respectively), social affect (ICC = 0.72; 0.84, respectively) as well as restricted and repetitive behavior (ICC = 0.85; 0.97, respectively). For the developmental measure, MZ twins had almost perfect and moderate agreement for visual reception and receptive language age equivalents respectively (ICC = 0.91; 0.69). DZ twins had moderate and almost perfect agreement for visual reception and receptive language (ICC = 0.63; 0.81). Expressive language levels showed the greatest heritability, with MZ twins showing strong agreement (ICC = 0.83) and DZ twins showing poor agreement (ICC = 0.29).
Conclusions:
Overall, in this small, pilot sample, we explored various behavioral traits which could shed light on differences in concordance between MZ and DZ twins. Both MZ and DZ twins showed strong agreement on autism symptomatology, precognitive abilities and receptive language. Expressive language skills show the greatest level of concordance, with MZ twins having significantly greater similarities than DZ twins. This language level difference could account for some of the differences we noted in age of first concerns. As our study is longitudinal, we expect to add about 30 more twin pairs to our sample as well as analyze eye-tracking to have another, objective measure to assess for concordance prior to the annual meeting.

224 **110.224** Play Ball!: Long-Term Sports Participation Is Associated with More Behavioral Regulation in Children with Autism Spectrum Disorder

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Background: Physical activity patterns of children with Autism Spectrum Disorder (ASD) are disorganized and repetitive (i.e., pacing; Bandini et al., 2013). These restricted and repetitive behaviors (RRBs) that make up the diagnostic criteria of ASD have been linked to executive functions (EF), a host of interrelated processes that support behavioral and emotional regulation. RRBs have been associated with poorer behavioral inhibition (Boyd et al., 2009). Challenges in EF are problematic because they hinder daily functioning. Sports team involvement (e.g., baseball) could help increase physical activity and also improve EF. To date, there has been little research linking physical activity and EF in children with ASD. However, studies have documented these associations in children with ADHD. Physical activity lowered compulsive behaviors and improved EF in children with ADHD (Archer & Kostrzewa, 2012). Given these associations, physical activity could also aid in these areas in children with ASD.
Objectives: Â To examine associations between sports participation and executive functioning (behavioral and emotional regulation) in children with ASD.
Methods: Participants were 15 children (8-11 years, *M*=9.7 years, *SD*=1.18; 93% boys) with a clinical diagnosis of ASD (confirmed using the ADOS-2; Lord et al., 2000), and their parents. ADOS-2 comparison scores across modules fell into the "moderate" severity range (*M*=6.6, *SD*=1.45; range 4 to 9). Full-scale IQ scores (WASI-II; Wechsler, 1999) were "low average" (*M*=88.73, *SD*=15.66). Parents reported on whether children participated in organized sports teams and the duration of their participation. Parents also completed the Behavior Rating Inventory of Executive Function (BRIEF; Gioia et al., 2000), the gold standard in measuring multiple domains of EF. For the present study, we examined the behavior regulation (e.g., "Is fidgety") and emotion regulation (e.g., "Mood changes frequently") domains of the BRIEF. Each index had 2 subscales (Behavior Regulation Index (BRI): inhibit and self-monitor; Emotion Regulation Index (ERI): shift and emotional control).
Results: Analyses of covariance were conducted between the duration of sports participation (<1 year, 1-2 years, and 2-3 years) and the four subscales of the two indexes of the BRIEF, controlling for child IQ. The results indicated a difference between the duration of sports participation and self-monitoring (BRI). Posthoc comparisons revealed significant differences between sports participants of <1 year and 2-3 years; children who participated in 2-3 years of sports had significantly higher self-monitoring than children who participated <1 year of sports (Figure 1). No significant effects were observed with the Inhibit subscale (BRI) or with the two ERI subscales.
Conclusions: Associations between long-term sports participation and self-monitoring skills in children with ASD were found. Self-monitoring, or the awareness of the impact of one's own behavior on others (Gioia et al., 2000), in the context of a sports team could influence the outcome of a game (i.e., winning/losing). As such, children who are motivated to help their team win may exert more effort in monitoring their own behaviors, though it is also possible that children who are better at self-monitoring are more likely to pursue sports involvement for a longer duration of time.

225 **110.225** Poor Sleep Quality Is Associated with Discordant Peer Relationships Among Adolescents with Autism Spectrum Disorder

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Background: Individuals with Autism Spectrum Disorder (ASD) experience impairments in social communication and restricted and repetitive behaviors (RRBs) (Centers for Disease Control, 2016), and these deficits often make it difficult to form and maintain friendships with peers. For example, children with ASD who have deficient verbal abilities have fewer social interactions, have less satisfying relationships with peers, and feel lonelier (Bauminger & Kasari, 2000; Sigman et al., 1999). As children approach adolescence, there is typically a quantitative shift to the majority of leisure time being spent with peers (Larson, 2001), yet this is often not the case for adolescents with ASD, who spend a large amount of time with adults (Orsmond & Kuo, 2011). For individuals with ASD, the consequences of social impairments and compromised relationships may be compounded by other challenges associated with ASD, one of which is poor sleep quality. Between 32% to 71.5% of children and adolescents with ASD experience sleep problems (Deliens et al., 2015). Sleep problems include difficulty falling asleep, inconsistent sleep schedules, insufficient nighttime sleep, and daytime sleepiness that impairs daytime functioning (Goldman et al., 2012). Poor sleep quality and daytime sleepiness are common among adolescents with ASD, and consequences of poor sleep may make social interactions difficult. Connections between sleep quality and social relationships in ASD samples have been understudied.
Objectives: The goal of the present study was to examine the associations between nocturnal sleep problems and daytime sleepiness in relation to the quality of peer relationships among adolescents with and without ASD.
Methods: Participants were community samples of 19 adolescents with ASD (aged 11-20 years, *M*=16.88, *SD*=2.50; 84.2% boys) and 10 neurotypical (NT) adolescents without a family history of ASD (aged 13-18 years, *M*=15.73, *SD*=2.00; 60% boys). Clinical diagnoses for the group with ASD were confirmed using the ADOS-2 (Lord et al., 2012). Adolescents completed questionnaires about closeness and discord in relationships with a same-gender peer, and they reported on sleep-wake problems and daytime sleepiness using the Sleep Habits Survey (SHS; Wolfson & Carskadon, 1998). Adolescents also wore an actigraph sleep watch to bed for 7-nights and kept sleep diaries of bed/wake times.
Results: Pearson correlations revealed significant associations between adolescent-reports of sleep problems and discordant peer relationships; more sleep-wake problems and more daytime sleepiness were associated with more discord with peers in the sample with ASD, but not in the NT sample. The closeness aspect of peer relationships was not significantly associated with sleep quality.
Conclusions: Adolescents' reports of more sleep problems and daytime sleepiness, but not actigraph indicators of sleep, were directly associated with discordant peer relationships. Adolescents who are already challenged in social interactions due to ASD may be especially vulnerable to intense negativity in peer relationships when they also experience poorer nighttime sleep and more daytime sleepiness. NT adolescents may be better able to regulate social interactions despite poor sleep and feeling tired. Conflicts with peers and daytime sleepiness in addition to nighttime sleep quality are important issues for clinicians to address in sleep and behavioral interventions.

226 **110.226** Positive Correlation Between Global and Fine Social Perception in Children with ASD: An Eye-Tracking Study

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Background: Social perception deficits are one of the main clinical characteristics of autism spectrum disorder (ASD). During the last decade, eye-tracking methodology has allowed an objective and quantitative characterization of these deficits.
Objectives: In this study, we aimed to investigate the relationship between two levels of social perception in children with ASD; global social perception, measured using a preferential viewing eye-tracking paradigm (Pierce et al. 2011), and fine social perception, measured using a social scenes eye-tracking paradigm (Saitovitch et al. 2016).
Methods: Twenty-six children with ASD (five girls, age = 10.3 ± 3.3) and thirty-nine typically developing (TD) children (thirteen girls, age = 9.5 ± 2.4) participated in this study. ASD diagnosis was based on DSM-IV-R and ADI-R criteria. Tobii T120 eye-tracker was used to measure gaze behavior during two eye-tracking paradigms: a social scenes paradigm and a preferential viewing paradigm. In the social scenes paradigm, participants were presented with movie fragments displaying social scenes with characters engaged in peer to peer social interactions. The number of fixation to the face and eyes of characters was compared between groups, controlling for gender and age. In the preferential viewing paradigm, participants were presented with a movie consisting of dynamic geometric images (DGI) and dynamic social images (DSI) displayed side-by-side simultaneously on the screen. The number of fixation to the DSI was compared between groups, controlling for gender and age. Finally, a correlation analysis was performed between the number of fixation in the face and eyes of characters in the social scenes paradigm and the number of fixation in the DSI in the preferential viewing paradigm.
Results: In the social scenes paradigm, statistical analysis showed significant reduced fixations to the face ($p < 0.001$) and to the eyes ($p < 0.001$) in ASD group compared to TD group. In the preferential viewing paradigm, significant reduced fixations in DSI was observed in ASD group compared to TD group ($p<0.001$). Correlation analysis showed a significant positive correlation between the number of fixations in the face during the visualization of social scenes and the number of fixations in the DSI in the preferential viewing paradigm ($p<0.05$) in children with ASD. Indeed, ASD children who looked less to the faces of characters were the ones who presented less preference for social movement. No correlation was observed in the TD group.
Conclusions: Taken together, these new results seem to indicate that abnormalities in the global process of preference for social movement over geometric movement would be associated with abnormalities in the process of face perception in ASD. Furthermore, these results may suggest that the more fine and complex social perception deficits in ASD could be predicted by more global social perception deficits.

227 **110.227** Positive, Negative, and Other Emotions in Young Autistic Children: The Importance of Context

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Background: Â Young autistic children are claimed to have excessively negative and dysregulated emotions, with pervasively reduced positive affect (Zwaigenbaum et al., 2013; Hirschler-Guttenberg et al., 2015). However, in preliminary data from the Montreal Stimulating Play Situation (MSPS; Jacques et al., 2015), young autistic and age-matched typical children displayed similar positive and negative emotions. These pilot findings raise questions about the importance of context and about autistic emotions perceived as “unknown” by typical observers (Yirmiya et al., 1989).
Objectives: Â To assess larger groups of age-matched young autistic and typical children with MSPS, and to further document the context of their emotions.
Methods: Â 37 autistic (mean age=45.8 months, SD=10.5; MSEL=74.0, SD=27.7) and 39 typical (mean age=41.1 months, SD=14.1, $p=0.124$; MSEL=103.0, SD=24.8, $p<0.001$) children were assessed with MSPS. Four play periods (free-play 1, semi-free play, semi-structured play, free-play 2) with 40 objects of potential interest to autistic children were filmed by a trained cameraman. Two naïve typical raters coded positive, negative, neutral, and unknown emotions on Observer XT 11©. Duration, frequency, and proportion of children displaying each emotion were analysed for all play periods, and associated with object explorations and repetitive behaviors.
Results: For the full MSPS, there were no significant group differences in frequency, duration, and proportion of children displaying positive, negative, or neutral emotions (p’s>.09). Positive emotions were pervasive and negative emotions rare in both groups. However, emotions coded as unknown were observed in 43.2% of autistic vs 0% of typical children ($p<.001$). Autistic children thus displayed significantly greater frequency (mean=3.5, SD=9.0, $p=.018$) and duration (mean=14s, SD=37s, $p=.019$) of emotions coded as unknown, compared to their complete absence in typical children.
For individual play periods, there were no significant group differences for positive, negative, or neutral emotions (p’s>.12) except in semi-structured play, with greater duration of positive emotions in typical (mean=104s, SD=109s) vs autistic (mean=59s, SD=58s, $p<.05$) children. Unknown emotions were significantly more frequent in autistic children in semi-structured and free-play 2 periods (p’s<.05).
For emotions associated with objects explored by >75% of children, across both groups positive emotions were expressed 18.9-76.9% and negative emotions 0-5.1% of the time, with no significant group differences for any object (p’s>.06). Emotions coded as unknown, unique to autistics, were observed 2.7-13.5% of the time (p’s=.018-.301).
Finally, for emotions in autistic children associated with their most-observed repetitive behaviors, positive emotions were observed during arm movements, hand flapping, and close gaze at objects (16.2%, 24.3%, 16.2% of the time, respectively), as were unknown emotions (8.1%, 5.4%, 5.4%). Negative emotions were not observed during any of these behaviors.
Conclusions: In a novel context of potential interest to them, autistic children expressed many positive and few negative emotions, particularly when exploring objects freely. Characteristically autistic repetitive behaviors co-occurred with positive, not negative, emotions. We did not find evidence of emotional dysregulation in young autistic children, compared to age-matched typical children with significantly higher MSEL scores. Autistic children uniquely expressed a range of emotions coded as unknown, suggesting there is room to improve our understanding of their full emotional repertoire.

228 **110.228** Preliminary Evidence Suggests Specific Impairments in Explicitly-Evoked Social Inferences in Adults and Children with Autism

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Background: Difficulties inferring others mental states may underlie social interaction deficits in Autism Spectrum Disorders (ASD). Behavioral studies (Chevallier et al., 2012) suggest that social inference deficits in autism are selective for implicit tasks. When cues are made explicit, people with autism may in fact be able to draw social inferences, but may fail to do so in everyday situations due to other attentional or perceptual shortcomings. Thus therapy may better target these different social cognitive processes.
Objectives: This study had two objectives. The first was to test whether social inference is intact in autism in an explicitly-cued task. If so, we then sought to determine whether this generalizes across two classes of social stimuli: hands and faces. The second objective was to corroborate behavioral findings with preliminary neuroimaging findings to explore whether behavioral similarities or differences between ASD individuals and matched controls are reflected in neural processing.
Methods: Behavioral responses were collected in 20 children (10 ASD) and 41 adults (22 ASD). Neuroimaging data were collected in 16 children (6 ASD) and 23 adults (2 ASD). All ASD subjects' diagnoses were confirmed with the ADOS. The Level of Inference (LOI) task (Spunt & Adolphs, 2014) tested explicitly-cued social inference. The LOI task asks subjects to make yes/no responses to how (low-LOI) and why (high-LOI) questions about pictures of people performing actions. Half of the stimuli featured faces; half hands. Responses were evaluated with respect to normative responses. All imaging data were collected in a 3T scanner. Adults performed the LOI task, while children completed a mentalizing task in which they "thought why" an actor performed an observed action in one of three conditions (emotional and nonemotional expressions, and hand actions).
Results: In the behavioral task, for Why-Hand trials, independent-samples t-tests showed that the percent correct for controls was significantly higher than for ASD subjects for both children ($p=0.019$) and adults ($p=0.002$). No other group effects were observed. Child neuroimaging preliminary results showed largely similar patterns across ASD subjects and controls in whole brain analyses. ROI analyses (independent samples t-tests) showed reduced left IFG activity ($p=0.039$) in the ASD group for non-emotional faces. ASD subjects tended to have less activation ($p=0.078$) in the right TPJ; in controls, LOI Why-Hand accuracy correlated with rTPJ responses to emotional stimuli ($r=0.798$, $p=0.005$) . Adult behavioral performance and brain activation maps were comparable to controls.
Conclusions: With the exception of hand stimuli, preliminary data indicate that both children and adults with autism can accurately perform tasks of explicitly-cued social inference. Small neural activation differences were observed in children, and will be further investigated with larger samples. Future work will explore which compensatory mechanisms might preserve explicit inferences about faces: stimuli with ambiguous facial expressions will test against the hypothesis that valence matching preserves Why-Face accuracy; and LOI and NEPSY-Theory of Mind accuracy will be compared. Our results indicate that to better understand everyday functioning in autism, the field should explore under what conditions implicit and explicit social inferences are impaired.

229 **110.229** Preservation of Emotional Awareness in ASD: A Preliminary Exploration Using the Leas-C

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Background:
Deficits in awareness of one's emotions and those of others are considered a fundamental weakness in ASD (Humphreys et al., 2007), and are a key target of psychosocial treatments for youth with ASD. Yet, hardly any studies characterize emotion awareness in ASD, and results from the extant literature are mixed. Some data show that youth with ASD perform comparably to TD controls when identifying situations associated with specific emotions (Capps et al., 1992), whereas other data indicate that youth with ASD have difficulty identifying emotional blends (e.g., "happy and sad") in emotionally evocative vignettes (Reiffe et al., 2006). The Levels of Emotional Awareness Scale for Children (LEAS-C; Bajgar et al., 2005) assesses a child's awareness of a broad range of emotions in oneself and others when presented with social vignettes. This scale has the potential to provide insight regarding capacity for emotional awareness in this population.
Objectives:
This study examines emotion awareness in ASD by exploring potential differences on the LEAS-C between youth with ASD and TD peers.
Methods:
Ninety-seven participants, 8 to 16 years, were enrolled from ongoing research studies. Two groups of children were examined: children with ASD and TD children without psychopathology. The ASD group was well-characterized using the ADOS-2, ADI-R and WISC-IV (VCI > 70). The LEAS-C was administered, which assesses children's awareness of their own and others' emotions in 12 real-life, social vignettes. The child reads each vignette and then writes the emotions s/he and a character in the story would feel. Time is unlimited. Responses are scored on a 5-point scale: 0 (unable to identify emotions; can identify cognitive states - "I'd feel confused"); 1 (can identify somatic features), 2 (can identify action or general emotional states - "I'd feel upset."), 3 (can identify unidimensional emotions - "I'd feel sad"), 4 (blends of emotions - "I'd feel relieved and disappointed"). A total score rates the emotional complexity of both responses. Group differences were analyzed using independent t-tests, and correlations were examined using Spearman-rank order correlations.
Results:
There were no significant differences between ASD and TD controls on Self [$t(95) = -1.026$, $p=.31$], Other [$t(95) = -1.710$, $p=.09$], or Total [$t(95) = -1.07$, $p=.29$] LEAS-C scores. Both groups averaged scores of "2" and "3" by item, indicating that responses focused on emotion related actions and reporting unidimensional emotions (e.g., "I'd feel sad"). Of note, scores in the TD group were comparable to previous studies using the LEAS-C (Veirman et al., 2011). LEAS-C scores did not correlate with age, gender, or IQ.
Conclusions:
Youth with ASD performed comparably to TD controls on a written measure of emotional awareness. This suggests that youth with ASD have the capacity to identify simple emotions when provided written descriptions and unlimited response time. This capacity, however, might be compromised in real world settings involving fast-paced reciprocal social interactions and reliance on deeper levels of emotional awareness including interoceptive processing. Interventions that can use these strengths to deepen emotional awareness in real world settings will be critical.

230 **110.230** Prevalence and Frequency of Online Sexual Activity in Adults with ASD

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Background: Researchers have only recently begun to assess a broad range of aspects of the sexual well-being of cognitively able adults with ASD (CA-ASD) using methods that overcame many early limitations (e.g., Byers, Nichols, & Voyer, 2013; Byers, Nichols, Voyer, & Reilly, 2013; Gilmour, Schalomon, & Smith, 2012). The results of these studies paint an overall positive picture for both individuals in and not in a relationship. One area of the sexual functioning of individuals with CA-ASD that has received little attention is use of the Internet to engage in sexuality-related activities. Yet, such activities are very common among neurotypical populations (Carroll et al., 2008; Daneback, Månsson, Ross, & Markham, 2012; Döring, 2012; Shaughnessy, Byers, & Walsh, 2011). Given the social impairments associated with ASD, it is possible that individuals with CA-ASD are more comfortable expressing their sexuality through on-line sexual activities because these activities do not require in-person, real-time interactions.
Objectives:
To determine the extent to which men and women in different age groups with CA-ASD engage in a range of online sexual activities (OSA) including non-arousal OSA (seeking sexual information, chatting), solitary-arousal OSA (S-OSA), and partnered-arousal OSA (P-OSA).
Methods:
Participants were a community sample of 141 men and 190 women (ages 21 – 73 years) with CA-ASDÂ who met cut-off criteria on the Autism Spectrum Quotient (AQ), a brief screening questionnaire designed to measure degree of ASD symptomatology in adults (Baron-Cohen et al., 2001).Â Participants completed an online questionnaire that included measures of ASD symptomatology, and online sexual activity.
Results:
Almost two-thirds of participants had engaged in one or more OSA. The most commonly reported online activities were watching sexually explicit videos (48%), masturbating while doing so (32%), and reading erotic material (32%). 21% of the sample had visited an education or dating website in the previous month; 54% had engaged in at least one S-OSA activity; and, 12% had engaged in at least one P-OSA activity. Significantly more of the men than women had engaged in Information Seeking and S-OSA but the men and women did not differ in their likelihood of having engaged in Chatting or P-OSA Experience. Individuals in their twenties were significantly more likely to have engaged in information seeking (34%) than were those in their 30's 40's, or over 50 (14%, 18%, and 18%, respectively), $X^2 = 11.88$, $p = .008$. The age groups did not differ in their likelihood of having engaged in the other OSAs.
Conclusions:
Most adults with CA-ASD engage in online sexual activity, and for the most part the likelihood of engaging in OSA was the same regardless of age. Men were more likely than women to engage in solitary-arousal activities but not in other forms of OSA. Few participants reported a problematic use pattern suggesting that OSA is generally a positive sexual outlet for adults with CA-ASD. Sexuality education programs are needed that incorporate OSA as a good alternative for some but also teach internet safety and strategies to reduce vulnerability to engaging in illegal OSA.

231 **110.231** Probing Social Motivation Heterogeneity in Young Children

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Background: There are vast knowledge gaps in understanding neurobiological mechanisms that contribute to the broad heterogeneity seen in social-affective behavior across human populations. This is particularly true for children with neurodevelopmental disorders whereby neural circuitry involving complex mental functions, such as social-affective processing, is disrupted. This processing, which can influence attention, motivation/reward, and emotional regulation, is a difficult construct to test in young children. While it is well documented that children with autism spectrum disorder (ASD) show disruptions in social behaviors, the underlying mechanisms driving those disruptions is less understood. Theories range in explanations that these social deficits arise from a lack of motivation for social interaction, to aversion to social interaction. These knowledge gaps in both understanding and measuring social-affective processes currently limits the design of effective and scalable interventions for improving disrupted social behavior. Strategies and tools are needed to better probe complex internal responses, such as feelings, drives, and motivations independent from language, and to decipher subtle behavioral consequences of these internal responses for low-verbal children including those with neurodevelopmental disorders.
Objectives: There were two goals of this study. The first was to build upon our previously established paradigm of conditioned place preference (CPP) for use in young typically developing (TD) children by adapting the task for use with a social unconditioned stimulus. The second goal was to use the social CPP task to probe whether the social interaction phenotype in children with ASD is due to an *aversion to* social interactions, or alternatively, *a lack of reward from* social interactions.
Methods: Typically developing children and children with ASD aged 36-60 months participated in this social CPP task. The task utilized Pavlovian conditioning methods in which a conditioned stimulus (CS) was repeatedly paired with an unconditioned stimulus (US), which elicited an unconditioned response (UR), and after successful conditioning, the CS elicited a conditioned response (CR) similar to the UR. Using a novel social experimenter as the US, and a custom-designed child-friendly arena, a castle, as the CS, the CS was paired with the US across four conditioning trials and we then measured place preference scores when the US was not present.
Results: Our results demonstrate that TD children display a robust social CPP ($p<0.05$) and that CPP scores correlate with sub-scales of the Mullen Scales of Early Learning. In comparison, the ASD group shows more heterogeneous conditioning scores in the social CPP task, revealing less preference for the social US in our preliminary data.
Conclusions: There is significant heterogeneity in the behavioral characteristics and genetic underpinnings of social behaviors in both TD children and children with ASD. The establishment of reliable and robust behavioral paradigms that can reveal differences in motivation, reward, and aversion for social stimuli, as utilized in this study, promises to transform approaches to assessment and intervention in young or low-verbal children, and to illuminate potential underlying neurobiological mechanisms responsible for the observed heterogeneity. This will allow for more precise interventions to target and reduce core social-affective symptoms of ASD.

232 **110.232** Quantifying the Dynamic of Visual Exploration of Complex Social Scenes in Children with Autism Spectrum Disorder (ASD) without Any a Priori: An Eye-Tracking Study

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Background: Numerous eye-tracking studies using predefined areas of interest (AOIs) have highlighted the atypical visual exploration pattern in individuals with ASD (e.g. tendency to look less at the eyes and faces compared to the group of typically developing (TD) individuals (for a review, see Klin et al. 2003)). The approach using AOIs is highly adapted for addressing specific research questions, like the one of relative dominance between different groups of AOIs (e.g. eyes vs. mouth). However, while it can inform us on what is more attracting for one group/person, it is less suitable for capturing the subtlety of the dynamic of visual exploration employed during viewing naturalistic social interactions, and how visual exploration of such scenes develops and changes with age.
Objectives: Our aim was to develop a method that will be able to define age-appropriate dynamic norms of visual exploration of complex social scenes, based on a group of TD children, for quantitative comparison with children with ASD.
Methods: A 3-minute "Trotro" cartoon was displayed on a Tobii eye-tracker device for 37 ASD males (aged 3.95±1.25) and 28 TD males (aged 3.10±1.30). Inspired by the concept of a *heatmap*, for each frame of the video we intended to create the "normative" gaze pattern distribution. This normative gaze distribution was obtained from TD subjects, employing kernel density distribution estimation on the raw gaze data of TD individual for each frame of the video (Botev et al., 2009). Once the "norm" was defined for each patient we calculated the "distance" of his/hers gaze coordinates form this "norm" in a frame-by-frame manner. For each patient we obtained one measure per frame of *Proximity from the "norm"*, and thus obtained measure was averaged for the duration of the video. Higher values indicate the visual exploration of the individual is being more similar to the one of TD subjects. The proximity measure was further correlated with direct measures of expressive, receptive language, cognition and imitation skills (PEP-3); indirect measures of communication and socialization skills (VABS-II) and severity of autistic symptoms (ADOS-2).
Results: We found positive correlation between proximity from the "norm" and direct measure of verbal & nonverbal cognition (R^2 = 0.19; p =. 008), language understanding (R^2 = 0.18; p =. 01), language expression (R^2 = 0.21; p =. 007) and imitation skills (R^2 = 0.15; p =. 02). We have also observed positive correlation between this measure and indirect measure of communication (R^2 = 0.24; p =. 004) and socialization skills (R^2 = 0.27; p =. 001), as parents reported them. Finally, a tendency toward negative correlation between the proximity from the "norm" and the severity of autistic symptoms was observed (p=. 0507).
Conclusions: Our results suggest that our method can be used as a valid measure for quantifying the dynamic visual exploration of complex social scenes based on a group of TD children, providing an age-appropriate manner to measure deviances in social cognition development in age-matched children with ASD. We further intend to use this measure in a longitudinal design.

233 **110.233** Ratings of Social Difficulties By IQ in Young Adults with ASD

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Background: Autism Spectrum Disorder (ASD) is a persistent and debilitating condition which frequently affects social ability. Despite increases in research examining social skills interventions for children and adolescents with ASD, few studies target social skills interventions for adults with ASD. Better understanding of areas of social deficit based on IQ would be helpful to understand how to design social skills interventions for young adults with ASD.
Objectives: This study examined the differences in self-report and other-report of social responsiveness of young adults with ASD when grouped by IQ.
Methods: Participants included forty-nine adults (77.6% male, 77.6% Caucasian) between the ages of 18- and 35-years-old (M = 23.19, SD = 4.13). Participants were divided into groups based on the median composite IQ score (<100, N = 24; >100, N = 25). Prior to beginning a social skills intervention, composite IQ was estimated using the Kaufman Brief Intelligence Scale, Second Edition (KBIT-2; M = 98.61, SD = 19.89). Participants and their elected reporters (parents or close family members) also each completed the Social Responsiveness Scale, Second Edition (SRS-2). Additionally, the participants completed the Achenbach Adult Self-Report (ASR) and a close family member completed the Achenbach Adult Behavior Checklist (ABCL).
Results: One-way ANOVAs revealed significant differences between the higher and lower IQ groups on the SRS-2 parent-report of social cognition (F=4.04, p = .05), SRS-2 self-report of social motivation (F = 5.91, p = .019), ABCL intrusive subscale (F = 4.15, p = .047), and ASR avoidant personality problems (F = 8.38, p = .006). Participants with higher IQs reported more problems with social motivation and avoidant personality problems, while participants with lower IQs had close family members report more problems with social cognition and intrusive behaviors. A significant correlation (r = .522, p = .007) was found between other- and self-report of social motivation as measured by the SRS-2 for the high IQ group only. A significant correlation (r = .435, p = .034) was found between other-and self-report of social cognition for the low IQ group only.
Conclusions: Participants with higher IQs experience more problems with social motivation (which participants and their elected reporters agreed on) and being avoidant of others, which may be a reflection of their difficulties with social anxiety. Participants with lower IQs experience more problems with social cognition (which participants and their elected reporters agreed on) and not understanding when they are being intrusive (e.g., not recognizing boundaries), which may be a reflection of their difficulties with understanding social cues. This reinforces the concept of having two slightly different tracks of the social skills intervention to give the two IQ groups a different experience that would be geared more toward what would help them succeed in social situations.

234 **110.234** Ratings of Social Difficulties By IQ in Young Adults with Autism Spectrum Disorder

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Background: Autism Spectrum Disorder (ASD) is a persistent and debilitating condition which frequently affects social ability. Despite increases in research examining social skills interventions for children and adolescents with ASD, few studies target social skills interventions for adults with ASD. Better understanding of areas of social deficit based on IQ would be helpful to understand how to design social skills interventions for young adults with ASD.
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235 **110.235** Reading Intention in Action: The Case of Autism Spectrum Disorder

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Background: Â Autistic traits span a wide spectrum of behavioral departures from typical function including impairments in communication, presence of restricted behaviors and difficulties in social interaction. It is a common experience that effective interaction with others often relies on the ability to decode others' intention. Recent evidence suggests that individuals with ASD have difficulties in anticipating the subsequent part of an action chain. To note, these anticipation difficulties emerge not only when performing the action (Fabbri-Destro et al., 2009), but also when observing someone else performing it (Cattaneo et al., 2007).
Objectives: Â The aim of the present study was twofold: 1. To test whether ASD children would be able to read someone else's intention from movement kinematics; 2. To test whether ASD children would be better at generating predictions about actions that are similar to their own.
Methods: Â Nineteen high functioning children with ASD (17 boys) as well as 17 TD children (13 boys) matched on age, IQ full scale and handedness participated in the study. The participants with ASD fulfilled DSM-5 (APA, 1994) criteria for autistic disorders. All participants were requested to observe video-clips of a hand reaching and grasping a bottle to either place it into a container or pour its content into a glass. Participants had to identify the intention underlying the observed movement. Crucially, video-clips were edited as to occlude the final part of the action, therefore participants could rely only on visual kinematics of the initial part of the action. To examine whether TD and ASD children use knowledge of their own kinematics to generate predictions, we manipulated the degree of similarity between the kinematics of the observer and the kinematics of the observed agent. Thus, in two separate blocks, we administered video-clips of movements performed by either TD or ASD children. In each block, video-clips for both pouring and placing action (50%-50%) were presented randomly. Block order was counterbalanced across participants. We assessed children's performance using t-tests on signal detection theory measures.
Results: Â The analyses revealed that ASD children's performance was at chance level in identifying the underlying intention. In contrast, a significantly above-chance identification rate was found for TD children (p<.05). Indeed, TD children were able to predict how the action would have unfolded even if presented only with its initial part. When contrasting performance for the two blocks separately, results indicated that neither TD nor ASD children were significantly better in predicting their own compared to others' movement (p_s<.05)
Conclusions: Â Overall, these findings are consistent with the idea that impaired social skills in ASD may - at least partially – be explained by anomalies in intention recognition from movement observation. Further analyses will test whether these anomalies correlate with motor execution abilities or with the severity of social symptoms in the attempt to shed light on the complex relationship between action execution, intention understanding and social skills in autism.

236 **110.236** Reading the Mind in the Eyes: Examining a Large Multicentre Dataset

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Background: Â Difficulties with aspects of social cognitive processing comprise a core symptom of Autism Spectrum Conditions (henceforth autism). Previous studies have identified differences in performance on the 'Reading the Mind in the Eyes' test (Eyes test) in individuals with autism (Baron-Cohen et al 1997, 2001 (JCPP), 2015 (PLoS ONE), Lai et al 2012 (PLoS ONE), Karlan et al 2008 (JADD), Lombardo et al., in press, Scientific Reports).
Objectives: Â Here we present data from the Eyes test collected as part of the EU-AIMS Longitudinal European Autism Project (LEAP), pooling data from 6 study sites. This study aimed to examine: 1) Categorical group differences (autism vs. controls and males vs. females) in performance (accuracy and reaction time). 2) The interaction between diagnosis and sex. 3) The effects of cross-sectional age on task performance. These differences were first considered in the complete sample, and secondly in separate age cohorts of children (6-11 years), adolescents (12-17 years) and adults (18-30 years).
Methods: Participants with a diagnosis of autism aged 6-30 years (N=329; 237 males, 92 females) and age matched typically developing controls (N=264; 174 males, 90 females) completed the Eyes task as part of a battery of cognitive tasks. Three versions of the task were administered using age appropriate mental state words and were translated into the native language of the different participating countries.
Results: Significant differences were identified for task accuracy between the autism and control groups ($F(1,588)=24.24$, $p<.001$, $r=0.2$), with fewer correct responses seen in the autism group. In addition, significant sex differences were identified ($F(1,588)=12.09$, $p=.001$, $r=.14$) with more correct responses seen in females. There was no significant interaction between diagnosis and sex and no differences in reaction time between the groups. A significant correlation was identified between accuracy and age, with an improved performance seen with increasing age ($r=.348$, $p<.001$). When examining the age groups separately, significant differences were identified between the autism and control groups in both the adult ($F(1,228)=6.15$, $p=.014$, $r=.16$) and adolescent ($F(2,203)=17.04$, $p<.001$, $r=.28$) samples, however there was no significant difference in the child group. Significant correlations between task accuracy and age were identified in the child ($r=.279$, $p<.001$) and adolescent groups ($r=.234$, $p=.001$) but were not seen in the adult group.
Conclusions: Performance differences were identified on this task, indicating impairment in complex emotion recognition associated with mental state attribution in individuals with autism. The finding of group differences is consistent with previous work, however in this case no interaction between diagnosis and sex was identified. Task performance was significantly associated with cross-sectional age, demonstrating improvements on the task with increasing age in children and adolescents but not in adults. Future work will examine the longitudinal data from this task to further examine the effect of development on task performance. Future work will also utilize an item level clustering approach to examining the data.

237 **110.237** Recounting Basic and Self-Conscious Emotional Experiences in Children with and without Autism Spectrum Disorders

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Background:
The ability to reflect on one's emotional experiences is central to emotional competence. Past research has shown that high-functioning individuals with ASD can discuss their experiences with basic emotions, but struggle with more complex emotions (Losh & Capps, 2006). This has important bearing on social functioning, as complex emotions, particularly self-conscious emotions, facilitate social relationships by motivating us to adhere to social norms (guilt) as well as personal standards (pride).
Objectives:
Most studies have focused on basic emotion processing in ASD using recognition paradigms (Uljarevic & Hamiliton, 2013). The purpose of this research was to examine children's verbal recounting of basic (happy, fear and sad) and self-conscious (pride, guilt, embarrassment) emotions that they have experienced. Relations between ASD symptomatology, Theory of Mind (ToM), cognitive skills, and recounting of emotions were also assessed.
Methods:
Twenty-three children with ASD and 36 neurotypical (NT) children were tested. Table 1 shows significant and non-significant differences between the groups. Children were asked to provide two different personal instances during which they experienced happiness, fear sadness, pride, guilt, and embarrassed emotions. Recounting was interspersed between other tasks not related to this study. Additional measures included ToM (Strange Stories and Faux Pas Detection), Child Autism Rating Scale-2, Social Responsiveness Scale-2, and the Wechsler Abbreviated Scale of Intelliegence-2. Children's recounts were coded using a system to gauge accuracy in responses, whether they included others in their recounts, and features related to specific emotions (e.g., presence of an audience with embarrassment).
Results:
The most compelling findings centered on the number of recounts provided: children with ASD gave significantly fewer recounts of each emotion than NT children, $t(56) = 2.49 – 3.80$, $p < .02$ (Table 2). Additionally, children with ASD gave significantly more recounts of happy, sad and pride experiences than fear, guilt or embarrassed experiences. Language ability, $r(21) < .17$, matrix reasoning, $r(21) < .41$, and FSIQ, $r(21) < .37$, were not related to the number of recounts children with ASD provided. These results correspond to statements made by children with ASD, including "I don't think I have ever felt guilty." or "I can't think of when I felt scared."
However, when providing a recount, children with ASD were strikingly similar to NT children (e.g., no significant differences were found in the accuracy of their recounts).Â Nevertheless, a few differences were found, to the extent that children with ASD made fewer connections to others in their recounts.Â ToM was positively related to number of emotion recounts in the ASD, but not in the NT group.
Conclusions:
The results showed that children with ASD struggled to recount personally experienced episodes of fear, guilt and embarrassment. These findings are consistent with research showing deficits in the understanding of fear (Tell et al., 2014), and research showing that individuals with ASD may be less prone to feelings of guilt (Davidson et al., 2015). These results were not due to differences in language or other intellectual abilities, although ToM skills were related to a number of findings in children with ASD, but not NT children.

238 **110.238** Relationship Between Executive Functioning and Adaptive Functioning within Autism Spectrum Disorder (ASD).

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Background: Autism Spectrum Disorder (ASD) is a heterogeneous disorder with varying abilities across domains such as cognition, executive functioning, and adaptive skills. Cognitive abilities range from impaired to well above average with approximately 31% of diagnosed children having an intellectual disability (ID; Baio, 2014). Deficits in Executive Functioning (EF) are also commonly observed, but EF abilities are varied (Hill, 2004). Prior research has explored the relationship between EF and adaptive functioning in individuals with ASD (McLean, Harrison, Zimak, Joseph, & Morrow, 2014), but there is little literature examining this relationship in individuals with ASD with intellectual impairment. In individuals with ASD and typical cognitive abilities, deficits in the EF skills of metacognition have been associated with deficits in adaptive functioning (Gilotty, Kenworthy, Sirian, Black, & Wagner, 2002). By examining the relationship between EF and adaptive functioning in a population with cognitive deficits, greater understanding of the relationship between EF and adaptive functioning can be gained.
Objectives: To 1) explore the relationship between EF and adaptive functioning in ASD and 2) expand our understanding of this relationship by incorporating children with ASD and cognitive impairment.
Methods: Participants were 82 children who met strict (ADOS, ADI) criteria for ASD participating in a study focused on the biological basis of ASD (64 male, M_{age} = 12.41, range = 5.33-17.67). Forty-six individuals had an IQ of 70 or greater, and 36 individuals had an IQ of less than 70. Correlations were conducted between composites of the BRIEF and the composite and subdomain scores of the VABS. A series of hierarchical linear regressions were also conducted to determine the amount of variance in each of the VABS composite and domain scores that was accounted by IQ, Metacognitive Index (MCI) scores, and Behavior Regulation Index (BRI) scores.
Results: Significant negative correlations were found between the BRI, MCI, and the four VABS measures for individuals with unimpaired cognitive functioning. Within this subgroup, MCI was a significant predictor of VABS Daily Living Skills ($\beta = -.439$, $t(42) = -2.507$, $p < .05$), and BRI was a significant predictor of VABS Composite ($\beta = -.416$, $t(42) = -2.451$, $p < .05$) and Socialization ($\beta = -.569$, $t(42) = -3.410$, $p < .01$). For individuals with IQs less than 70, significant negative correlations were found between the MCI and the VABS Composite, Communication, and Daily Living Skills. However, regression analyses indicated that only IQ significantly predicted performance on the VABS domains in this subgroup.
Conclusions: Â Our results support previous findings indicating that in individuals with ASD and typical cognitive abilities, EF abilities are associated with adaptive skills. However, we found that EF abilities in the realm of behavior regulation were greater predictors of adaptive functioning than metacognitive abilities. While moderate correlations are found between metacognition and adaptive functioning domains in individuals with cognitive impairment, it does not appear that metacognitive abilities are significant predictors of adaptive functioning. Overall, findings suggest that the relationship between EF and adaptive functioning differs in individuals with ASD and cognitive impairment than individuals with ASD with intact cognitive abilities.

239 **110.239** Relationships Between Engagement States and Early Functioning in Children with Autism and Typical Development

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Background:
In both Typically Developing (TD) children and children with ASD, different engagement types have been found to influence language development (1). For example, Joint Attention (JA) and Supported Joint Engagement (SJE) have been shown to predict later vocabulary (3). More specifically, Bottema-Beutel et al. (2014) reported that after dividing SJE into 'Higher' and 'Lower' only HSJE predicted later social communication and expressive language in children with ASD. However, it is not clear which aspects of SJE are most relevant for language growth, nor whether participation in SJE is uniquely facilitative for children with ASD, as Bottema-Beutel et al., (2014) did not compare SJE and JA, nor did they compare children with ASD and TD children.
Objectives:
We extend the paradigm of Bottema-Beutel et al., (2014) to a new sample of children with ASD, compare them to TD children, and investigate how each of the different engagement states are related to the children's early language scores.
Methods:
Participants include 15 children with ASD (ASD_{MAge}=34.93 months, 12 males), and 15 TD children (TD_{MAage}=19.82 months, 13 males), recorded at 3 visits, 4 months apart, and initially matched on language level (raw scores) ($ASD_{MullenEL}$=16.44(6.22), $TD_{MullenEL}$=20.35(5.70)). Children and caregivers engaged in 30-minute play sessions, which were coded for episode types in two separate waves. First, three types of JA were coded, designated as when the child and caregiver alternated between looking at each other and an object, with the child either responding (RJA) or initiating (IJA), or JA being mutually established (JA). Second, two types of SJE were coded, designated as when the caregiver influenced the child's object play, but the child engaged with the caregiver without visually referencing him/her (1): Higher (HSJE) occurred when the child responded by reciprocating and collaborating with the caregiver and Lower (LSJE) occurred when the child responded without reciprocal or collaborative exchange with the caregiver. A seventh episode type, Passive Attention (PA) was coded when caregivers followed the child's attention with no behavioral response. Correlations were performed between children's durations of engaging in each episode type and their Mullen scores.
Results:
In the TD group, only Expressive language correlated significantly with joint activity; children with higher scores also engaged in longer episodes of JA (r=.5419, p=.0369). In contrast, in the ASD group four significant correlations were obtained: Children with better Receptive language engaged in longer RJA episodes (r=.5697, p=.0335) and shorter LSJE episodes (r=-.5593, p=.0376), and children with better Visual Reception engaged in longer HSJE episodes (r=.6618, p=.0099) and longer RJA episodes (r=.6233, p=.0172).
Conclusions:
These findings demonstrate different patterns of correlations in children with ASD and TD children, with joint activities being related to cognition as well as language in the ASD group but only language in the TD group. We next investigate whether the aspects that predict children's later vocabulary growth will also be different in the 2 groups, and compare which engagement states are predictive of later language development.

240 **110.240** Same Day, Different Gaze: Task Effects on Eye Gaze to Social Stimuli

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Background:
Atypical eye gaze is a canonical symptom of Autism Spectrum Disorder (ASD; Kanner, 1943), but attempts to use eye-tracking to analyze aberrant gaze patterns have produced mixed results (Papagiannopoulou et al., 2014). This variability may be due to different task demands, which are known to affect eye-tracking patterns in TD individuals (e.g., Triesch et al., 2003; Radun et al., 2014).
Many passive-listening studies have found that individuals with ASD look less at the eyes of unfamiliar actors than their neurotypical (TD) peers (Klin et al., 2002; Sterling et al., 2008; White, et al., 2015). However, emotion identification tasks often don't show these group effects (Bal, et al., 2010; Sawyer et al., 2012; Spezio et al., 2007). This variability in results may reflect differences between task-driven versus passive gaze in individuals with ASD.
Objectives:
To analyze the effect of task type (passive viewing versus emotion-identification) on eye gaze patterns to social stimuli in children and adolescents with and without ASD.
Methods:
Participants were children and adolescents ages 10-17, 19 with ASD (3 females) and 25 TD controls (8 females), who were not significantly different in language ability as measured by the CELF-5 (ASD M = 113, TD M = 114), IQ as measured by the K-BIT (ASD M = 117, TD M = 107), and gender.
Participants watched videos of human actors while eye gaze was recorded in two separate tasks. During one task, participants passively viewed adolescents talking about their lives. In the other task participants were asked to identify the emotion on a speaker's face.
We calculated emotion-identification accuracy in the second task as well as percent dwell times to the actors' face, eyes, and mouth in both tasks.
Results:
There was a main effect of diagnosis for gaze time to the face, with ASD participants looking less across both studies. We also found a significant interaction of task and diagnosis on gaze to the eye region. Post-hoc tests revealed that participants with ASD looked less to the eye region than TD participants during passive listening. In the emotion identification task, there were no differences in eye gaze or in accuracy rates across groups.
Conclusions:
Participants with ASD looked less at the eyes than their TD peers when passively watching a video, but both groups showed similar gaze patterns during emotion identification from faces. Reduced social motivation among individuals with ASD could explain reduced gaze to the eye region in the passive viewing task. It is possible that this lack of social interest is then overridden by a desire to successfully complete a task (McClelland, 1987), thereby eliminating the group difference in gaze pattern during the emotion identification task. In summary, our analysis shows that gaze patterns of adolescents with ASD to faces can change with the addition of a concrete task demand. Therefore, variability of results in previous eye-tracking studies may reflect effects of the tasks, rather than the natural propensity of individuals with ASD to gaze at faces.

241 **110.241** See No Emo, Hear No Emo, Feel No Emo? the Effect of Seeing Versus Hearing Emotions on Mood in Autism Spectrum Conditions

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Background: Â Observing an emotional display (e.g. another person laughing) often leads neuro-typical observers to mimic, recognise and 'catch' the underlying emotion themselves, resulting in a subjective change in mood. This emotional contagion is suggested to have evolved as a social mechanism to foster group cohesion by creating a bond between individuals engaged in the shared emotional display (Provine, 2004). Individuals with Autism Spectrum Conditions (ASC) reportedly demonstrate reduced emotional contagion when observing displays of emotions (e.g. Helt et al., 2010), but emotional displays contain visual and auditory information, and it is not yet known whether emotional contagion is driven primarily by visual or auditory sensory processing. Atypical auditory processing been noted previously in individuals with ASC, but contemporary emotion recognition interventions typically focus on visual processing, for example by training participants to read facial expressions. Understanding the relationship between sensory processing and emotion processing could improve emotion interventions for people with ASC.
Objectives: This study aimed to determine whether emotional contagion is driven primarily by hearing or by seeing displays of emotions, and whether this differs in people on the autism spectrum.
Methods: Forty-four adults with ASC and 49 neuro-typical adults participated in the study. Participants watched two video montages of strangers exhibiting realistic displays of emotions: one montage in audio-only format (sound files with a blank visual display) and another in visual-only format (muted video clips). The emotion depicted in the videos was a between-subjects factor, such that half of the participants watched video montages of laughter and half watched video montages of crying. Participants were asked to rate their mood before and after each video montage, so emotional contagion as a result of each video montage could be measured. The items in the mood rating scales were taken from the PANAS (Watson et al., 1988).
Results: Data were subjected to a 2 (Participant group: ASC, Control) x 2 (Sensory information: Audio, Visual) x 2 (Emotional expression: Laughing, Crying) ANOVA. A main effect of Participant group was found, with participants in the ASC group finding the emotions displayed in the videos significantly less contagious than Control participants. A significant interaction was also found between Sensory information and Emotional expression, driven by the absence of emotional contagion when seeing visual-only displays of laughter.
Conclusions: Participants with ASC found emotions less contagious than neuro-typical adults, but the impact of sensory information was the same for both participant groups. Rather, the impact of seeing versus hearing emotions was dependent on the emotion being expressed. Hearing others laughing and crying resulted in comparable emotional contagion, but without sound, the facial expressions involved in laughter failed to trigger any change in mood. Although the nature of contagion is yet to be studied for other emotions, this research suggests the auditory properties of laughter are particularly important for fostering a positive collective mood. This finding has implications for individuals with ASC who block out auditory stimulation in social situations, because this may create another barrier to inclusivity within a social group.

242 **110.242** Self-Perception and Friendship Relationships of Teenagers with High-Functioning Autism in Mainstream High Schools: A France – Quebec Study.

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Background: For a decade, an increasing number of students diagnosed with ASD (including Asperger syndrome) was able to attend mainstream high schools in both France and Quebec (Cappe, Smoke, & Boujut, 2014; Kalubi, Chatenoud, Guillemette, Larivée, & Leroux, 2015). Over the years, this increasing number of ASD youths has come to represent a greater proportion of all children with special educational needs in regular schools (French Ministry of Education, 2015). However, little is known about how the French and Quebecois teenagers with ASD cope with different aspects of inclusion. For these students, whose inherent difficulties lie in social interaction and communication, taking into account social challenges of mainstreaming experience is essential (Humphrey & Lewis, 2008; O'Hagan & Hebron, 2016).
Objectives: To examine self-perception and friendship relationships in teenagers with ASD attending mainstream high schools in France and Quebec and how these variables influence their experience of school inclusion.
Methods: 23 students with ASD (age range 12 – 16 years) participated in the study. All of them attended high school full-time, in France (n=15) and in Quebec (n=8). Written informed consent was obtained from each participant and his parents. Youths filled out the *Friendship Qualities Scale* (FQS; Bukowski et al. 1994) – 5 dimensions, and the *Self-Perception Profile for Adolescents*(SPPA; Harter, 1988) – 9 dimensions.
Results: Internal coherence of scales was satisfactory in both sets of data (Cronbach α > .70). Cluster analyses identified 3 groups on the FQS scales and 4 groups on the SPPA questionnaire. The FQS clusters were named *socially isolated* (N = 8), *sociable* (N=7) and *average* (N=8). SPPA clusters were labeled *school difficulties* (N=8), *school-work oriented* (N=5), *low self-esteem* (N=4) and *socially performing* (N=6). Cross-tabulation of these profiles revealed that 80% of *school-work oriented* youths considered themselves as *socially isolated*, with low scores in social and friendship self-evaluation. As expected, *sociable* youths did not consider themselves as *isolated.* Youths with *school difficulties* were equally distributed across the 3 self-concept profiles. Despite the identical mean score for *Global Self-Worth* in both *socially performing* and *school-work oriented* groups, the *socially performing*group shows higher mean scores in almost all dimensions measured by FQS and SPPA. This study was part of a larger doctoral research including semi-structured interviews with both teenagers with ASD and their parents, in order to provide a more comprehensive picture of the experience of school inclusion. Analyses of interviews realized with these participants illustrate specific problems of school adjustment as well as factors that facilitate mainstream inclusion for students with ASD.
Conclusions: These results underscore the importance of taking into account diversity in ASD adolescent profiles and social adaptation strategies. Despite the heterogeneity, the data suggest the importance of friendship relationships and their influence on a satisfying self-perception. The diversity of self evaluations of friendships and self concept suggest that self assertion and social skills training focusing on high functioning autistic youth's specific problems in high school mainstream programs might be an important pathway to successful inclusion and academic perseverance.

243 **110.243** Self-Perception of Academic Competency in Autism Spectrum Disorder

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Background:
Self-perception is the ability to understand and reflect upon one's own competency to perform in the world. Although individuals with ASD struggle with certain areas, these individuals tend to overestimate their abilities when asked about their symptomatology, social functioning, and academic abilities. This lack of awareness may make it difficult for individuals to adjust their behaviours in accordance with feedback, leading to greater impairments over time. While there is a growing body of literature examining overestimations of competency in individuals with ASD, little research has focused on examining how different parameters influence this phenomenon.
Objectives:

1. To examine if self-perception of academic competency in children with ASD differs from typically-developing (TD) controls.
2. To examine if estimations of competency change after providing feedback on a task.Â

Â Methods:
Eighty participants, 40 with ASD and 40 TD controls (age range =10-15 years), will participate. Currently 14 participants with ASD, and 21 TD controls have been tested and data collection will be completed for the conference. Participants complete three conditions of an academic task: 1) Correct: participants are asked how many questions they think they answered correctly, 2) Incorrect: participants are asked how many questions they think they answered incorrectly, 3) Feedback: participants are provided with feedback after each question. Participants are asked how well they think they will do prior to completing the task (pre-prediction) and are asked how they think they did after completing the task (post-performance). Difference scores between actual and predicted performance are used in data analysis.
Results:
Preliminary results suggest that the ASD group ($M_{pre\text{-}prediction}$ = 6.14, $M_{post\text{-}performance}$ = 4.93) tends to overestimate their performance before ($t(33) = 2.31$, $p = .02$) and after ($t(33) = 3.50$, $p = .001$) completing the correct condition compared to TD controls ($M_{pre\text{-}prediction}$ = 3.10, $M_{post\text{-}performance}$ = 1.05). Results also suggest that the ASD group ($M_{pre\text{-}prediction}$ = 4.93, $M_{post\text{-}performance}$ = 5.43) tends to overestimate their performance before ($t(33) = 2.84$, $p = .008$) and after ($t(33) = 4.55$, $p < .001$) completing the incorrect condition compared to TD controls ($M_{pre\text{-}prediction}$ = 1.52, $M_{post\text{-}performance}$ = 1.23). No differences were found between the groups actual performance on all tasks. When comparing the conditions within groups, the ASD group was more accurate on the feedback condition ($M_{post\text{-}performance}$ = 2.29) compared to the correct ($t(13) = 3.58$, $p = .003$) and incorrect ($t(13) = 2.76$, $p = .016$) conditions. No differences were found between the feedback ($M_{post\text{-}performance}$ = 0.65) and the correct and incorrect conditions in the TD group.
Conclusions:
Examining how different parameters affect how children with ASD self-evaluate will further our understanding of mechanisms underlying this phenomenon. Preliminary results suggest that children with ASD tend to overestimate their competencies before and after completing objective tasks. The findings also suggest that the ASD group's estimation of competency is more accurate after receiving feedback on the task. A greater understanding of these mechanisms will not only help us understand more about the development of self-perception in ASD but about this population in general.

244 **110.244** Self-Regulation Strategies during a Delay of Gratification Task: Group Differences in Children with ASD and Typical Development

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Background:
Significant research with children with typical development (TD) has shown that the ability to delay gratification predicts positive outcomes such as improved school readiness and better social adaptation (Feldman & Klein, 2003; Mischel, Shoda, & Peake, 1988). Certain strategies involving self-distraction such as gaze aversion have been shown to facilitate children's ability to wait for a reward on the Delay of Gratification task (DoG; Cournoyer & Trudel, 1991; Mischel et al., 1988), a seven-minute assessment in which children are challenged to postpone immediate gratification in favor of a larger, more desirable reward. In contrast, temptation behaviors, including direct gaze toward and touching the reward, can interfere with successful performance on this task (Ostfeld-Etzion et al., 2015). Although one prior study found 6-7 year old children with autism spectrum disorder (ASD) were less able to delay gratification (Faja & Dawson, 2015), no research has investigated the self-regulation and temptation behaviors used during the DoG by these children.
Objectives:
One purpose of our study was to assess group differences (ASD vs. TD) in the ability to delay gratification using a young sample of children. We also wanted to investigate group differences in children's self-regulation strategies and engagement in temptation behaviors during this task by children with autism and typical development.
Methods:
Our sample included 104 children (ages 3:0 to 6:11), 57 (46% female) with TD and 47 children with ASD (17% female). Children completed a seven-minute Delay of Gratification task developed by Walter Mischel (1988) in a laboratory setting. Videotapes of the task were coded for total wait time, self-regulatory behaviors, which included gaze aversion, kinetic movement, and verbal mediation, and temptation behaviors including direct gaze and touching the food reward.Â Total wait time was used as an index of children's ability to delay gratification.
Results:
Using independent samples *t*-tests to assess group differences (ASD vs. TD) related to the DoG, we found ASD children had shorter wait times than children with TD ($t = -2.13$, $p = .03$). There were no significant group differences in percentage of time using any individual self-regulatory strategy: gaze aversion ($t = -.83$, $p = .41$), kinetic movement ($t = .67$, $p = .53$), and verbal mediation ($t = .15$, $p = .88$). However, children with autism spent a higher percentage of time engaged in touching behaviors ($t = 2.78$, $p = .007$) compared to their TD peers (see Table 1).
Conclusions:
These results support prior research on the reduced ability to delay gratification in children with ASD and extend this research to a younger sample. We also found that the time spent in self-regulation strategies by children with ASD did not differ significantly from their typically developing peers. However, children on the autism spectrum spent more time engaging in temptation behaviors such as touching the reward. We know of no other research that has investigated the unique behaviors of children with ASD during the DoG task. Future research should investigate whether specific self-regulatory behaviors are effective in helping these children successfully complete this task.

245 **110.245** Sequential Associations Between Caregiver Talk and Child Play in Autism Spectrum Disorder and Typical Development

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Background: In the early phases of development, caregiver-child play often involves caregiver talk about children's play (McDuffie & Yoder, 2010; Siller & Sigman, 2008). Although originally studied to facilitate language, these types of utterances might elicit particular types of child play and visa versa. When children play at their most developmentally advanced level, this may prompt the caregiver to provide yet more talk related to the play experience, in a mutually reinforcing manner (Alessandri, 1992). These contingencies may be especially important to understand in children with autism spectrum disorder (ASD), to better support caregiver-child interactions within play contexts. We focused on two main types of caregiver talk: responsive talk that relates to the child's current focus of attention, termed *follow-in utterances*; and utterances that relate to the caregiver's focus of attention and *not* the child's focus of attention, termed *caregiver-focused* utterances. Follow-in utterances can be further parsed into *follow-in directives*; those that suggest or direct the child to do something different with a toy the child is already playing with, and *follow-in comments*; those that describe the state of affairs regarding the toy the child is already playing with but do not suggest or direct the child to do something new.
Objectives: Â To determine whether: (a) child functional play is more likely to elicit caregiver follow-in utterances than exploratory play, (b) follow-in utterances are more likely to elicit functional play than caregiver-focused utterances, (c) follow-in comments are more likely to elicit functional play than follow-in directives, and (d) any of the above sequential associations differed for children with ASD as compared to TD children.
Methods: Fifty children with ASD and 48 TD children who were group-wise matched on mental age (mean mental age ≈ 14 months across groups) were recorded during a free play interaction. Recordings were coded for caregiver talk and child play using 5 s partial-interval sampling. Sequential analysis methods were used to answer research questions. An index of sequential association was used as a dependent variable in mixed-effects models to account for nesting of behavioral sequences within caregiver-child dyads. Chronological age was used as a control variable in each mode.
Results: Analyses showed sequential associations between child play and caregiver follow-in utterances were stronger in the ASD group than the TD group, but did not differ according to play type. Follow-in utterances elicited functional play while caregiver-focused utterances had an inhibitory effect, and this distinction was more prominent for the ASD group than the TD group (Figure 1). Finally, across both groups of children, follow-in directives were more likely than follow-in comments to elicit functional play (Figure 2).
Conclusions: Our results indicate that, more so than TD caregivers, caregivers of children with ASD time their utterances to follow child play. Also, children with ASD may be particularly likely to benefit from caregiver's follow-in talk when engaging with toy play. Our findings also invite a reappraisal of the role of directives (previously considered 'asynchronous) in caregiver-child play, given our findings that follow-in directives elicit developmentally high-level play.

246 **110.246** Shared Mechanism for Emotion Processing in Adolescents with and without Autism

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Background:
Autism spectrum disorders (ASD) are characterised by significant deficits in social interaction and communication skills. Atypicalities in the affective domain are central to ASD and research suggests that individuals with ASD react to social cues differently from typically developing (TD) individuals. The roots of such difficulties are still debated but it has been suggested that difficulties in processing emotional cues play an important role in these social deficits. This hypothesis has led to a considerable amount of work pointing to emotion recognition difficulties, yet, a number of studies have found that people with ASD do recognise emotions accurately.
Objectives:
Here, we shift the focus to ask whether the *mechanisms*behind emotion processing are the same in ASD, irrespective of potential differences in accuracy between ASD and TD groups. To do so, we focus on the contextual impact of gaze on emotion recognition for two reasons: Firstly, we know that neurotypical adults better decode and rate as more intense anger paired with direct gaze and fear when coupled with averted gaze (labelled here Threat+), as compared to the other emotion-gaze combinations (threat-), and secondly, because it is theoretically possible to distinguish different mechanisms that may affect the integration of these social cues, using model-based analyses of participants' accuracy.
Methods:
20 adolescents (12-17 yrs) with ASD and 20 age-, gender-, IQ- matched TD controls participated in a two-choice emotion categorisation task (fear or anger). In each trial, participants were presented with a facial expression of anger or fear of varying intensity (7 levels of emotion strength), paired with direct or averted gaze, for 250ms, and had to categorise the expressed emotion (4 second response window).
To identify the computational mechanisms accounting for the influence of gaze direction on emotion categorization, we compared two models: model 1, where gaze direction would bias responses towards Threat+ combinations and model 2, where gaze direction would enhance the perceptual sensitivity to Threat+ combinations. We used Bayesian model selection and calculated the Bayesian information criterion (BIC) to determine which of the two models was more likely to explain the observed data.
Results:
Behavioural data revealed that the ASD group displayed lower overall performance (TD:86%; ASD:82%). Yet, gaze direction had a similar impact on emotion categorisation in both groups, i.e. improved accuracy for Threat+ combinations (figure 1a). Critically, computational modelling of participants' behaviour reveals that the same mechanism, i.e. increased perceptual sensitivity, underlies the contextual impact of gaze direction in both groups (figure 1b).
Conclusions:
Adolescents with ASD, while being overall less accurate in emotion recognition, are able to integrate gaze direction with facial expressions of emotion similarly to TD adolescents. Importantly, the mechanisms behind such integration are the same as in both TD adolescents and neurotypical adults (El Zein et al., 2015). We discuss the specific experimental conditions that may favour emotion processing and the automatic integration of contextual information in ASD.

247 **110.247** Shared Zones and Autism Spectrum Disorder

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Background: Shared zones present an alternative means of calming traffic whilst promoting active travel, and social civic engagement. Shared zones are characterized by the removal of markers traditionally delineating the road and footpath. They are regulated by basic traffic rules with design features encouraging informal social interactions between users to promote safe behaviours. Safe negotiation of a shared zone relies on an individual's ability to rapidly scan, assess and respond to ambiguous social stimuli. This ability may be impacted by impairments in cognitive processing, such as autism spectrum disorders (ASD), potentially compromising the safety of vulnerable users. There is a paucity of research examining the impact of shared zones on the visual scanning patterns of pedestrians with and without social difficulties.
Objectives: Â To compare the visual scanning patterns of pedestrians with and without ASD when crossing a shared zone, benchmarked against traditionally marked pedestrian crossings (zebra crossings).
Methods: Head-mounted eye-trackers were used to record participants' eye movements as they completed a series of crossings across in a shared zone and a zebra crossing. Eye movements were measured as number of fixations, fixation duration and location relative to predetermined areas of interest (AOI). AOIs were categorised as traffic relevant and not-traffic relevant. The eye movements of 40 adult pedestrians, 19 with ASD and 21 typically developing, were successfully recorded.
Results: A total of 3,287 fixations were analysed. The eye tracking data revealed that all pedestrians were less likely to look at traffic relevant objects in the shared zone (47.1%) compared to the zebra crossing (59.1%). There was no between group difference in relation to fixations on traffic relevant versus not traffic relevant objects between pedestrians with ASD and the control group. Pedestrians with ASD did, however, have 16msec shorter median fixation durations overall compared to the control groupÂ ($p<0.001$). The total number of fixations with eye contact were miniscule across both groups, showing no difference between the groups, neither in the shared zone, nor at the zebra crossing.
Conclusions: It has been proposed that shared zones increase the attention and care taken by users. However, both groups fixated more on traffic relevant objects at a zebra crossing suggesting that zebra crossings cue pedestrians to attend to traffic relevant objects to a higher degree than a shared zone regardless of impairments in cognitive processing. The clear lack of difference in visual scan patterns between the groups indicated that participants with ASD were no more at risk in the shared zone than pedestrians without ASD. Observed between group differences in fixation durations, with pedestrians with ASD exhibiting shorter fixation durations overall, suggest that those with ASD processed visual stimuli more rapidly or inadequately in comparison to their typically developed peers. This finding requires further investigation. Finally, the few fixations that could be classified as eye contact across both groups, potentially challenge the idea that shared zones increase social interaction between road users.

248 **110.248** Social Cognitive Profiles of Adults with Autism and Schizophrenia

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Background: Severe social dysfunction is the principal impediment reducing quality of life and social outcomes in adults with autism spectrum disorder (ASD) and schizophrenia (SCZ). Investigations of the mechanisms underlying social dysfunction in SCZ and ASD have focused on impaired social cognition, and recent genetic, behavioral, and neuroimaging data suggest substantial overlap in the social cognitive phenotypes in the two disorders.
Objectives: No study to date has systematically examined social cognitive profiles in ASD and SCZ to elucidate patterns of similarity and distinction. Delineating patterns within matched samples on a common set of standardized tasks assessing multiple domains of social cognition is imperative for identifying areas of convergence and divergence that can inform treatment efforts for each disorder.
Methods: Adults with ASD (n=79), SCZ (n=95), and typically-developing (TD) individuals (n=128) completed eight tasks spanning 4 domains of social cognition: A) attribution style/bias was evaluated with the Ambiguous Intentions and Hostility Questionnaire (AIHQ); B) emotion recognition was assessed with the Bell Lysaker Emotion Recognition Task and the Penn Emotion Recognition Test; C) social perception was measured with the Relationships Across Domains test; d) mental state attribution was assessed with the Reading the Mind in the Eyes Test, The Awareness of Social Inferences Test, Part III, (TASIT), and the Hinting Task. Participants also completed the Trustworthiness Task, which does not fall cleanly into the four domains.
Results: Â The groups were comparable on IQ (group mean range: 102.07–105.30; p=.11), but differed on gender (90% male in ASD, 80% in TD, 74% in SCZ; p=.048), age (group mean range: 23.61-26.97; p<.01), and ethnicity (90% Caucasian in ASD, 76% TD, 64% SCZ; p<.01). Gender, age, and ethnicity were covaried in analyses.
A MANOVA of the group differences was significant, $F(16,564)=7.10$, p<.001, and follow up one-way ANOVAs indicated significant differences between the groups on all tests (*p's*<.04). TD individuals scored significantly higher than both clinical groups on emotion recognition, social perception, and mental state attribution tasks (*p's*<.001). TD individuals rated faces significantly more trustworthy than SCZ (p=.04), but not ASD individuals (p=.53). On the AIHQ, TD individuals trended towards significance compared to the SCZ group (p=.08), with the SCZ group rating more bias to blame others, but did not differ compared to the ASD group (p=.99)
When directly compared, the ASD and SCZ groups performed significantly different on TASIT (p=.01) and approached significance on the AIHQ (p=.06). The ASD group was less accurate in detecting lies and sarcasm, and individuals with SCZ showed a stronger attribution bias to blame others for negative outcomes. The clinical groups did not differ from each other on the other social cognitive tasks (*p's*>.50).
Conclusions: Although individuals with ASD and SCZ shareÂ significant social cognitive impairments, they also exhibit some disorder-specific distinctions, including a greater hostility bias in SCZ and reduced ability to detect lies and sarcasm in ASD. These may contribute to social dysfunction in unique ways, and treatment efforts may benefit from targeting these different profiles to improve quality of life and outcomes for adults with these disorders.

249 **110.249** Social Discounting in Autism Spectrum Disorder

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Background: In social discounting tasks, participants choose between a smaller monetary reward for themselves versus a larger reward for partners of varied social distance (e.g., a sibling versus an acquaintance; Jones & Rachlin, 2006).Â Participants' choices thus implicitly measure the subjective value of rewards given to others, capturing constructs such as social closeness or perspective taking. Indeed, variability in social discounting has been linked to externalizing disorders (Sharp et al., 2012), episodic thinking (Yi et al., 2016), and empathy (Olson et al., 2016). Quantifying social discounting rates in ASD may help explain and predict relationships with close and distant others, but, to date, no research has examined social discounting in autism.
Objectives: To assess social discounting in adolescents and adults with ASD.
Methods: Forty-four typical individuals (16 males, average age=20.23 years) and sixteen individuals with ASD (13 males, average age=20.08 years) participated. We also analyzed data from a subset of 16 typical participants matched on age, sex, and verbal IQ. Participants were first told to list four individuals that they knew personally: Partner 1 was the person they were closest to; Partner 2 was someone else they knew well; Partner 3 was a person they knew a little; and Partner 4 was a person who they would recognize, but did not know well. Participants then completed a computerized social discounting task for each partner, understanding the task to be hypothetical. On each of six trials, participants chose between $100 for their partner versus a lower variable amount (titrated between $1.57 and $98.44) for themselves (Figure 1). This algorithm revealed the value at which the participant considered a reward to him or herself to be equal to giving $100 to the partner. Lower values corresponded to increased discounting (e.g., valuing others' rewards less).Â As a control, participants completed a delay discounting task, in which they chose between receiving $100 at a future time point versus receiving a lower amount today. This ensured that effects were not driven by task comprehension, general discounting, or understanding of money.
Results: A repeated-measures ANOVA examining social discounting found a main effect of group membership, with ASD participants showing increased discounting. The interaction between group membership and social partner level was also significant (p=.041; Figure 2); ASD participants showed no difference in discounting for Partner 1, but increased discounting for more distant partners (i.e., showed less value for rewards given to these social partners; Partner 2, p=.002; Partner 4, p=.062). Delay discounting also revealed a main effect of group (p=.008), but no interaction between group and time point. Across both tasks, trends were similar but not significant for the matched typical group.
Conclusions: Overall, individuals with ASD showed no difference in social discounting for their closest social partner, but did show quicker drop-offs in the value of rewards given to individuals outside of this most intimate relationship. Additional data are being collected to examine the relation between social discounting and social cognitive abilities, to better assess the causes and consequences of social discounting.

250 **110.250** Social Inclusion of Children with ASD Who Have Moderate to Severe Intellectual Disabilities

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Background: For children with moderate to severe intellectual disabilities (ID), there are often barriers to participating in social situations. This issue may be particularly salient in those children who additionally have a diagnosis of autism spectrum disorders (ASD). Research has shown that children with ASD have fewer friends, are invited less frequently to peer events and generally experience more instances of exclusion than typically developing peers. However, among children with ASD with co-morbid ID, it is difficult to know whether the social isolation experienced derives from intellectual disability or whether the impairment in social skills found in ASD further exacerbates this issue. Although efforts are made by teachers and parents to integrate children with ASD in these situations, understanding the social needs and experiences of children with ASD, over and above those with moderate to severe intellectual disabilities, may allow for true inclusion in schools and the community.
Objectives: In this study, children with ID with and without ASD were observed at a social, community (e..g, sports, scouts) or school setting (i.e. at recess or during gym class) with a coding scheme designed for behavior observed. We measured the available opportunities for interaction and the rate of actual interactions "in situ", in order to assess the inclusion of these children in activities with peers and adults to determine the differential experiences of children with ASD and those without.
Methods: 10 children with ASD and ID and 13 children with an ID (ranging from 6.6 to 17.5 years of age; median IQ = 38.68) were observed in unstructured social settings. Total number of available interactions (defined as another person being in close proximity, or within 2 meters, during a social event), total interactions (spoken, play, physical contact, etc.) and who the interaction was with (typically developing peer, peer with a developmental disability or adult). To standardize for differences in observation length, all available opportunities and interactions were calculated as rates per 15 minutes.
Results: There was no difference between the ID and the ASD + ID groups in the overall proportions of interactions ($p > 0.05$). However, children with ASD + ID had fewer interactions with peers who had developmental disabilities (13% of available opportunities) compared with children with just ID (36%), $t(45) = 2.80$, $p < 0.01$). Within the ASD group, adults had significantly more frequent interactions (33% of available opportunities compared to 13%) than children with developmental disabilities ($t(37) = 2.35$, $p = 0.02$).
Conclusions: These results indicate that children with ASD and ID have fewer social interactions with children with developmental disabilities than children with ID alone in unstructured social situations. This lack of interaction with this key group of peers who face similar barriers can exacerbate the isolation experienced by children with ASD. Also, the increased interactions with adults compared to this group, may give caregivers a false impression of social inclusion. Further analyses examining differences in the proportion of interactions within groups, and relations to social and adaptive measures are ongoing.

251 **110.251** Social Pupillary Response in Children and Adolescents with Autism Spectrum Disorder

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Background: The neural mechanisms underlying autism spectrum disorder (ASD) have been found to vary significantly across the life span. For example, prior research has shown enlarged brain volume and neuronal overgrowth in individuals with autism up until they hit adolescence when abnormal degeneration occurs (1,3). Eye tracking and pupillometry have been used extensively in studies of social processing and autonomic response in ASD (2,6) and allow further investigation into the age-specific neurophysiologic differences associated with the progression of autism.
Objectives: The primary aim of this study was to utilize pupillary response to visual stimuli as a way to explore potential age-specific social processing abnormalities associated with ASD.
Methods: Individuals between the ages of 5 and 30 with a clinical diagnosis of ASD and age- and gender-matched typically developing controls (TDC) were recruited at Indiana University. Participants viewed a 60-second, side-by-side social scenes and geometric patterns eye tracking paradigm similar to those used in previous studies of social processing in ASD (4,5). The primary measures were average and maximum Social to Geometric Pupil Ratio ($SGPR_{avg}$, $SGPR_{max}$). All ASD participants underwent a battery of psychological testing and caregiver behavioral evaluations. Participants were further grouped into adolescent and child cohorts depending on whether they were older or younger than 12 years old.
Results: Thirty-seven ASD and twenty-six TDC provided evaluable pupillometry data. There was no difference between ASD and TDC individuals in pupillary measures nor was there a correlation between pupillary measures and age. Notably, there was a statistically significant interaction between ASD vs. TDC and adolescent vs. child on $SGPR_{avg}$ [$F(1, 63)=4.349$, $p=0.042$] with the child ASD group having an elevated social pupillary response and the adolescent ASD group having a decreased response compared to TDC.
Conclusions: The interaction between ASD vs. TDC and adolescent vs. child on social pupillary response indicates that changes in adolescence may have an effect on social responsiveness in individuals with ASD. Further investigation into the age-specific neural mechanisms underlying social processing in ASD is required.

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252 **110.252** Social Visual Engagement during Dyadic Interaction in Infants with and without ASD

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Background:
Infant-caregiver interactions are both the platform and the catalyst for subsequent development, as mutually-adapted infant and caregiver behaviors create cycles of contingency that scaffold infants' emerging abilities and facilitate further interaction (Fogel & Thelen, 1987). Given the importance of contingent social interaction in guiding typical development, this study investigates whether infants with Autism Spectrum Disorder (ASD) are sensitive to two critical aspects of social experience—contingency and familiarity—within the context of face-to-face dyadic interactions. Identifying aspects of early social experience that are disrupted in ASD may provide an early diagnostic marker of the condition, and may also inform our understanding of the developmental processes through which early atypical experiences culminate in symptoms of ASD.
Objectives:
This study examines sensitivity to social contingency and familiarity in typically developing (TD) infants and those with ASD by measuring infant social visual engagement with: (1) a *familiar* social partner interacting with them *contingently,* (2) a *familiar* social partner interacting with them *non-contingently*, and (3) an *unfamiliar* social partner engaging with them *non-contingently.*
Methods:
Participants were 2-5-month-old typically developing infants (typical outcomes confirmed at 24 months; n=14, mean age=4.40(0.23) months, 7 female), and 2-5-month-old infants with ASD (data collected prospectively, prior to diagnosis; diagnostic ascertainment performed at 24 months; n=8, mean age=4.33(0.20) months, 1 female). Eye-tracking and video data were collected monthly between 2 and 6 months while infants viewed: (1) a closed-circuit live video feed of their caregiver (*familiar/contingent*, Figure 1A); (2) pre-recorded clips of their caregiver (*familiar/non-contingent*); and (3) pre-recoded clips of unfamiliar actresses (*unfamiliar/non-contingent*) (Figure 1B). Regions of interest were coded in each video, and percentage of fixation time on eyes was compared between groups and conditions.
Results:
Consistent with prior analyses (Jones & Klin, 2013), eye-looking at this cross-sectional age point is present at levels that are similar between groups ($p<0.51$). In TD infants, eye-looking showed a trend towards increasing as a function of both contingency and familiarity: TD infants look most at the eyes when interacting contingently with their caregiver, less when viewing a non-contingent recording of their caregiver, and least when viewing pre-recorded non-contingent strangers (Figure 2A). By contrast, infants with ASD showed no modulation of eye-looking as a function of contingency (Figure 2B). They instead demonstrated a trend towards increased eye-looking when viewing familiar versus unfamiliar caregivers. Immediate next steps include further examination of these trends in a larger sample.
Conclusions:
Preliminary findings suggest that, from the earliest months of life, sensitivity to social contingency may be disrupted in infants with ASD. While TD infants look more at the eyes of those who are engaging with them contingently, levels of eye-looking were not modulated by contingency in infants with ASD. Instead, visual engagement in infants with ASD may be more strongly influenced by the familiarity of their social partner. Future analyses will examine the emergence and refinement of sensitivity to social contingency longitudinally, and will include measures of reciprocal social smiling and time-varying mutual gaze as further indices of sensitivity to social contingency.

253 **110.253** Sport Experiences for Youth with Autism Spectrum Disorder (ASD) and Intellectual Disabilities (ID)

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Background: Youth with intellectual disabilities (ID) have lower sport participation rates than their typically developing peers (Westendorp et al., 2011) but little is known about patterns of sport participation in youth with Autism Spectrum Disorder (ASD). Grandisson and colleagues (2012) discuss a conceptual approach to understanding sport participation in individuals with ID using *personal* and *environmental* factors – an approach that is beneficial for assessing similar participation issues for those with ASD and ID.
Objectives: The present study aims to i) examine differences in positive sport experiences for youth with ASD and ID compared to youth with ID alone and ii) examine the relations among personal factors (adaptive behaviour, behaviour problems), environmental factors (available resources, coach relationship, parent support of sport), and positive sport experiences in youth with ASD.
Methods: As part of a larger study examining sport participation in youth with ID, parents of youth involved in Special Olympics (*N*=411) completed online questionnaires about personal and environmental factors, and sport experiences. Parents (81% mothers) were 34 to 67 years of age (*M*=49.39, *SD*=6.14) and children with ID (64% male) ranged in age from 11 to 23 years (*M*=17.20, *SD*=3.05), with 29% having a diagnosis of ASD. Parents reported on their support of sport and the child-coach relationship, as well as their child's sport experiences (Teamwork & Social Skills subscale, YES 2.0; Hansen & Larson, 2005), adaptive behaviours (SCA; Mazurek et al., 2012; W-ADL; Maenner et al., 2012), behaviour problems (SDQ; Goodman, 1997), and resources (PEMCY; Coster et al., 2012).
Results: A two-way ANOVA (gender X ASD status) was used to investigate differences in quality of the sport experience between youth with ASD and ID compared to youth with ID alone. There was no main effect of gender and no significant interaction, however, there was a trend towards a main effect of ASD status, such that youth with ID alone (M = 2.76, SE = .10) had greater positive sport experiences compared to youth with ASD and ID (M = 2.36, SE = .19), $F(1, 397) = 3.43$, $p = .07$. Mediation analyses using the PROCESS macro (Hayes, 2012) revealed significant pathways for personal and environmental factors. Specifically, sociocommunicative abilities, the quality of the coach relationship, and parent support of sport had significant indirect associations between ASD status and positive sport experiences.
Conclusions: The findings suggest that experiences may not be the same for all youth with ID involved in sport, such that youth with ASD and ID may have fewer positive sport experiences compared to youth with ID alone. Further, differences in personal and environmental factors may explain the relationship between ASD status and sport experiences. These findings suggest that additional supports may be required in sports for youth with ASD with social communication deficits or difficulties with support from their coach or parents. The present study contributes to our understanding of sport experiences in youth with ASD and ID, and may have implications for improving social supports in sport for all youth with ID.

254 **110.254** Task Related Differences in the Theory of Mind Profile of School-Aged Children with ASD

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Background:
Impairments in social functioning in autism spectrum disorder (ASD) are theoretically linked to an underlying deficit in theory of mind (ToM)–the social cognitive ability to take another's perspective. Previous research has consistently documented ToM impairments in preschoolers with ASD (Baron-Cohen, Tager-Flusberg, & Cohen, 2000), but the investigations of ToM deficits in school-aged children with ASD and average IQ have produced mixed results (Scheeren et al., 2013).
Objectives:
To examine the pattern of individual differences in ToM in school-aged children with ASD and average IQ using a battery of ToM measures (e.g., precursors of ToM, first-order false belief, and second-order false belief). To compare ToM performance between children with ASD and typical development.
Methods:
To date, 41 children with ASD between the ages of 7-11 years have participated. All children had an ASD diagnosis (ADOS-2, ADI-R, DSM-5) and WASI-2 Full Scale IQ of 80 or higher. The ToM battery included tasks measuring: (1) precursors of ToM (TOM Test-Level 1 and Perception Knowledge task), (2) first-order false belief (Location Change False Belief task, Unexpected-Contexts False Belief task, and TOM Test-Level 2), and (3) second-order false belief (TOM Test-Level 3). The TOM Task (Muris et al., 1999) was presented on a laptop and all other measures were presented as videos with pre-recorded questions. We are currently collecting data from typically developing children (anticipated sample size of 30) and will compare the performance between groups. We are also collecting data from additional children with ASD (anticipated final sample size of 65).
Results:
ToM precursors were not significantly related. Instead, age related improvements were detected on Perception Knowledge, $r(41) = .34$, $p = .03$, whereas TOM-Level 1 related to language level, $r(29) = .44$, $p = .02$. Performance across first-order false belief tasks were related, Chronbach's a=.65; rs > 0.36, ps < .03. Within these measures, Location Change False Belief improved with age, $r(40) = .37$, $p = .02$, and TOM-Level 2 performance was associated with language ability, $r(29) = .40$, $p = .03$. Finally, the second-order false belief measure, TOM-Level 3, was sensitive to both age, $r(40) = .42$, $p = .01$, and language level, $r(29) = .50$, $p = .01$. Across all measures, nonverbal IQ was not related ToM. Finally, ADOS-2 severity scores were examined with respect to ToM. More severe symptoms related to worse performance only on the Unexpected Contents Task, $r(36) = -.40$, $p = .02$.
Conclusions:
Overall, our research has important implications for understanding the heterogeneity in social functioning and social cognition in school-aged children with ASD. First, variables within a ToM level were only moderately related at best. Second, some tasks in our battery measuring multiple levels of ToM continue to detect developmental changes in ASD–even among school-aged children without cognitive impairment (i.e., Perception Knowledge, Location Change, and TOM-Level 3). As with previous work (Steele, Joseph, & Tager-Flusberg, 2003), language level influenced performance, especially for the TOM Task. Finally, ToM performance was generally *not* related to ASD symptoms in this age range.

255 **110.255** The Association Between Theory of Mind, Executive Function and the Symptoms of Autism Spectrum Disorder

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Background:
Many dominant theories of autism spectrum disorder (ASD) assert that atypical cognitive processes contribute to the expression of observed autistic symptoms. In particular, it is proposed that theory of mind (ToM) impairments relate to the expression of social and communication difficulties, and that poor executive functions associate with the presence of restricted and repetitive behaviours (RRBs). However, experimental evidence is mixed and comprehensive investigation has been limited by small and unrepresentative sample sizes and the absence of wide-ranging task batteries. Further, most previous research has focussed on a cognitive domain in isolation, meaning broader conclusions about the pattern of cognition-behaviour associations cannot be drawn.
Objectives:
We used structural equation modelling (SEM) as a parsimonious and statistically robust way of exploring the associations between ToM and executive function and parent-reported measures of social communication and RRBs.
Methods:
Participants were 100 adolescents (mean age = 15 years 6 months; SD = 6 months) with ASD from the Special Needs and Autism Project (SNAP). The mean full-scale IQ was 84 (SD = 18). Four tasks were used to measure ToM (False belief, Strange stories, Frith-Happé animations, Reading the Mind in the Eyes) and six tasks were used to measure executive functions (Opposite worlds, Card sort, Category fluency, Design fluency, Digit span, Planning drawing). Symptoms of ASD were obtained via parent-report, with the Social Responsiveness Scale (Constantino & Gruber, 2005) used to measure social communication behaviours and the Repetitive Behavior Scale-Revised (Bodfish et al., 2000) used to measure RRBs. SEM enabled different theoretical models of the interrelationships between the multiple measures to be tested and compared.
Results:
Our final model had acceptable model fit (CFI = .89; RMSEA = .05). ToM ability was associated with both social communication symptoms (standardized coefficient = -.41) and RRBs (standardized coefficient = -.42). In contrast, EF was a correlate of ToM but had no direct association with parent-reported symptom expression.
Conclusions:
Our data suggest ToM ability, but not EF, is related to autistic symptom expression in adolescents with ASD. This suggests that the previously held theoretical position that ToM is not relevant to RRBs needs reconsidering.

256 **110.256** The Broad Autism Phenotype, Emotion Recognition, and Romantic Relationships

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Background: The broad autism phenotype (BAP), or subclinical features of autism spectrum disorder (ASD), has been identified in people both with and without relatives with ASD. Broad autism phenotype features include aloof personality, rigid personality, and pragmatic language deficits. People with higher levels of BAP features have more intimate relationship difficulties than those with lower levels of BAP features, whether or not they have a relative with ASD. People with higher levels of BAP also have difficulty understanding others' facial expressions, which may impede their ability to initiate and maintain romantic relationships.
Objectives: The purpose of the study was to explore the relationship between BAP features, emotion recognition skills, and romantic relationship functioning in emerging adults with and without relatives with autism.
Methods: Participants (*N* = 235, 80% female, mean age = 20) were in two groups: (1) emerging adults with no known relatives with ASD (No Relative Group; *n* = 115) and (2) emerging adults with relatives with ASD (Relative Group; *n* = 120). Relatives were most often siblings (*n* = 49) and cousins (*n* = 57) of people with ASD. Approximately 54% of the participants (*n* = 127) were in a romantic relationship at the time of the study. All participants completed an online survey, which included the Broad Autism Phenotype Questionnaire, the Reading the Mind in the Eyes Task, the Dating and Friendship Questionnaire, and the Social and Emotional Loneliness Scale.
Results: Participants with higher BAP scores had significantly fewer numbers of past romantic relationships compared to participants with lower BAP scores. Similarly, participants with higher BAP scores had significantly weaker emotion recognition abilities compared to people with lower BAP scores. Mediation analyses revealed that people with higher BAP scores experienced fewer numbers of romantic relationships, in part because of their weaker emotion recognition skills. There was no association between BAP scores and romantic loneliness, relationship satisfaction, and duration of current romantic relationships. Additionally, participants with the BAP (n = 60) and without the BAP (*n* = 175) did not differ in their current dating status. Participants in the Relative and No Relative group did not differ on their average number of past romantic relationships or on their scores of emotion recognition.
Conclusions: It is important for parents without the BAP to model strong emotion recognition skills (e.g., by emphasizing how others feel based on their facial expressions) for young adults who exhibit features of the BAP in order to promote healthy romantic relationships. It is also important to inform family members of people with ASD about the BAP so that relatives who exhibit more BAP features may recognize these features in themselves and can experience the benefits of romantic relationships by seeking help and resources. By improving the quality of life of relatives of people with ASD, these individuals will be empowered to provide better care and advocacy for their relatives with ASD.

257 **110.257** The Broader Autism Phenotype As It Relates to Interoception, Alexithymia, and Emotion Processing

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Background: The ability to process information from our internal bodily state has been found to relate to socio-emotional competence (Ferri et al., 2013). Neurotypical adults who show high interoceptive accuracy (IA) in sensing and tracking bodily signals such as heart rate are found to experience emotions with heightened intensity (Pollatos et al., 2007), and work with individuals with ASD has also examined IA, though results are mixed. Some studies have found increased IA in ASD (e.g., Schauder et al., 2015), while others have found impaired IA (e.g., Garfinkel et al., 2016). Recent studies have suggested that alexithymia, a personality construct characterized by impairments in sensing, identifying, and describing one's emotions, might mediate associations between ASD and IA (Shah et al., 2016) as well as ASD and emotion processing (Cook et al., 2013). More work is needed to understand how the associations among these factors might relate to the broader autism phenotype (BAP).
Objectives: The present study investigated the relations between characteristics of the BAP, IA, alexithymia, and emotion recognition in the general population.
Methods: The present sample included 36 undergraduate students (14 male). Participants completed a heartbeat perception task, where they were asked to silently count their heartbeats without physically feeling their heart or pulse. Heart rate was recorded using a Biopac MP150WSW system. After this task, participants completed a series of questionnaires to measure aspects of socio-emotional competence. Characteristics of the BAP were measured through the Social Responsiveness Scale, Second Edition (SRS-2; Constantino & Gruber, 2012); alexithymia was assessed with the Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994); and emotion recognition was assessed using the Reading the Mind in the Eyes Test (RMET; Baron-Cohen, et al., 2001). Based on prior work by Pollatos et al. (2007), IA was calculated as the mean accuracy in heartbeat perception across three randomly-ordered time intervals.
Results: Characteristics of the BAP were found to be positively related to alexithymia, $r(33) = .648$, $p < .001$, and a trend towards a negative association with emotion recognition was also found $r(34) = -.321$, $p = .056$. Alexithymia was negatively related to emotion recognition, $r(33) = -.373$, $p = .027$, and on further analysis, when controlling for alexithymic traits, the marginal association between BAP and emotion recognition disappeared ($r(32) = -.113$, $p = .525$), consistent with previous work. When examining these aspects of socio-emotional processing in relation to IA, only the RMET was found to be significantly associated, $r(34) = .411$, $p = .013$, such that those who were more accurate in detecting their heartbeats also showed better accuracy in recognizing others emotions.
Conclusions: Consistent with past work in ASD, the present study found a) increased BAP characteristics were associated with higher levels of alexithymia, b) higher levels of alexithymia were associated with worse emotion recognition, and c) relations between BAP and emotion recognition were mediated by alexithymic traits. Further, better interoception related to better emotion recognition. Future work will expand the present sample to further explore the relationship between IA and socio-emotional competence as it relates to the BAP.

258 **110.258** The Development of Face Expertise in Autism and the Own Race Advantage

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Background: Â Face perception atypicalities have been well-documented in relation to autism spectrum disorders (ASD), for example, suggesting a lack of 'face expertise' (Schultz, 2005). These abnormalities are important to understand as they link to the defining social impairment in ASD. Studies in typical development (TD) show that adults and children are better at recognising faces of their own race than those of another race (own-race-advantage; ORA). The ORA demonstrates how experience (e.g. increased exposure to own race faces) shapes face perception and provides an interesting way of probing the role of experience/expertise in face perception in ASD. Two papers have explored the ORA in autism, but have provided inconsistent findings (Hui-Lin-Chien et al., 2014; Wilson et al., 2011).
Objectives: Â The aim of this study was to explore the development of the ORA in children with ASD compared to TD children in Japan. We hypothesized that the ORA would be reduced in children with ASD compared to TD children. Critically, we used a face recognition task with 4 different stimuli manipulations to explore how manipulating information from different areas of the face impacted upon recognition (e.g. eye vs. mouth). We hypothesized that children with ASD would have the most difficulty in the easy-eye and hard-eye condition, in line with the idea that difficulties with face expertise in ASD are linked with attention to the eyes.
Methods: 52 participants (7- 16 years, 24 ASD, 28 TD children, matched on age and non-verbal ability) completed a sequential face recognition task. The task was adapted from Hui-Lin Chein et al., 2014). Participants were shown a face (3s) followed by a blank screen with a fixation cross (1s), followed an image with two faces. From the two faces, participants had to identify the face they had previously seen. The additional face was either a completely different face (IC;identity change), or the same face as before with a manipulation: easy eyes (EE; eye change), hard eyes (HE; eye spacing change) or hard mouth (HM; change in spacing between nose and mouth). Half of the 64 trials contained Asian faces and half were Caucasian.
Results: A 2X4 factorial ANOVA revealed a main effect of condition whereby both groups found each manipulation increasingly difficult (IC < EE <HE <HM), but no interaction with group. Therefore children with ASD did not suffer an atypical decrement when recognition dependent upon changes in the eyes region. Although there was a trend towards significance, a main effect or interaction effect for the race of the face was not found (p = .07), therefore an ORA was not clearly demonstrated in either group
Conclusions: The current study lends support to the idea that children with ASD do not demonstrate an ORA. However, in this case neither did the TD children. Additionally, children with ASD showed the same pattern of performance across the conditions indicating they did not have particular difficulties in noticing changes dependent on the eye region. The implications will be discussed.

259 **110.259** The Effectiveness of Social Skills Treatment for Adolescents with Autism Spectrum Disorder

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The Effectiveness of Social Skills Treatment for Adolescents with Autism Spectrum Disorder. A. Pulido-Banner*1 and A. J. Lincoln2, (1) Alliant International University.

Background: Treatment options for social skill deficits in adolescents with Autism Spectrum Disorder (ASD) are limited. Throughout the lifespan, individuals must learn to conform to society's social expectations or face becoming isolated from peers (Dereli-Iman 2014).Â The PEERS program (Laugeson, 2014) was created to address the many complexities faced by treating adolescents with ASD and the unique hardships faced when attempting to learn social skills. The PEERS program is an evidence-based program for teen's with ASD and non-ASD teenagers with disorders that involve social skill deficits (Laugeson, 2014). Currently the sole source of information used to assess social skill ability has been informant report because it is inexpensive, quick, and easy and provides fairly reliable data (Matson & Wilkins, 2009). Some limitations to self-report are the lack of generalizable data and poor consistency across informants which can cause shared method variance (Kaugars et al., 2011). The CASS is currently the only published observational tool to measure ASD symptoms and can be used to increase external validity in evidence based social skills treatment programs (White et al., 2015)

Objectives: The aim of this study was to replicate the findings from the empirically supported PEERS program and to evaluate the effectiveness of a, social skills program for adolescents with ASD by comparing outcome results from informant report and an evidence based observational measure.

Methods: Participants to date are twenty-two 12:0 to 17;11 year-old adolescentsÂ with a diagnosis of ASD. ASD diagnoses were confirmed by the ADOS, ADI-R or a qualified mental health professional using the DSM-IV or DSM-V. All participants scored ≥ 70 on standardized measures of intellectual and language abilities. Participants were randomly assigned to either 10 group therapy PEERS sessions (n=22) or a 10- week waitlist (n=10). The participants from the waitlist group were then crossed over into the treatment group following the 10 week waiting period. Outcome measures included Social Communication Questionnaire (SCQ), Social Skills Improvement System Parent and Teacher (SSIS-P, SSIS-T), Quality of Play Questionnaire-Adolescent version (QPQ-A), Social responsiveness Scale Parent and Teacher (SRS-P, SRS-T), Test of Adolescent Social Skills Knowledge (TASSK), Symptom Checklist 90 Revised (SC-90), Friendship Qualities Scale (FQS), Social Anxiety Scale-Parent and Adolescent (SAS-P, SAS-A) and The Contextual Assessment of Social Skills (CASS).

Results: Preliminary findings suggest that adolescents who completed a 10-session PEERS program evidenced clinically significant improvements in social skill ability as measured by self-report, informant report and observational measures. Improvements in conversation skills were found in teens who completed PEERS treatment. Comparative outcomes for participants in the PEERS and waitlist groups will be presented.

Conclusions: Preliminary evidence suggests that the PEERS program demonstrates improvement in social skill ability for adolescents with ASD when measured via informant report or through direct standardized observation employing the CASS. However an unexpected post hoc finding suggested that levels of anxiety increased among adolescents with ASD who participated in the 10 week PEERS treatment group.

260 **110.260** The Effects of Diagnostic Disclosure, ASD Knowledge, and Peer ASD Symptomology on the Perception of Vignette Characters with ASD

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Background: Few studies have examined what factors influence and/or increase the positive engagement of peers who interact with individuals with ASD. Given that individuals with ASD experience stigmatizing attitudes from peers (Humphrey & Lewis, 2008) and that peers themselves endorse such attitudes (Obeid et al., 2015), there is a need for further research in this area.

Objectives: The goal of this study was to examine three factors that may influence peer perception of individuals with ASD: (1) the peer's awareness of the individual's diagnosis, (2) the peer's knowledge of ASD, and (3) the extent to which the peer experiences symptoms characteristic of ASD.

Methods: 203 undergraduate students were randomly assigned to read a series of vignettes wherein the main character exhibited behavior characteristic of ASD and disclosed: (1) an ASD diagnosis, (2) an unrelated diagnosis (e.g., depression), or (3) no diagnosis. Participants' perceptions toward the vignette character were examined using the Openness Scale (Nevill & White, 2011) and the Affect, Cognition, and Behavior Subscales of the Multidimensional Attitudes Scale (Findler et al., 2007). Participants' knowledge of ASD was assessed by an author-created questionnaire, and the Autism Spectrum Quotient (Baron-Cohen et al., 2001) was used to evaluate participants' ASD symptomology. Four hierarchical linear regressions (dependent variables: Openness, Affect, Cognition, Behavior) were used to analyze the data.

Results: Across all regressions, participants had more positive perceptions of characters who disclosed an ASD diagnosis compared to those who did not disclose a diagnosis, Openness: $t(197) = -5.21$, $p < 0.01$, Affect: $t(196) = -2.33$, $p = 0.02$, Cognition: $t(200) = -3.47$, $p < 0.01$, Behavior: $t(198) = -4.07$, $p < 0.01$, but there were no significant differences in perception of characters who disclosed an ASD versus unrelated diagnosis. Greater knowledge of ASD was associated with more openness, $t(197) = 2.90$, $p < 0.01$, and positive affect, $t(196) = 4.90$, $p < 0.01$, toward vignette characters. Participants who endorsed having more symptoms of ASD reported more distancing behavior, $t(198) = -2.79$, $p = 0.01$, less openness toward vignette characters who revealed an unrelated diagnosis, $t(197) = -3.08$, $p < 0.01$, and more negative affect toward vignette characters who did not reveal a diagnosis, $t(196) = -2.48$, $p = 0.01$. See Table 1 and Figure 1.

Conclusions: Overall, peers responded more positively when vignette characters disclosed a diagnosis, regardless of the nature of that diagnosis. Diagnostic disclosure may provide peers with a cognitive explanation for odd social behaviors demonstrated by the vignette character and/or may lead peers to experience more empathy for the vignette character. Peer knowledge of ASD was associated with more positive perceptions of vignette characters, suggesting that further work should be done to educate peers about ASD. Finally, peers who endorsed ASD symptomology had more negative perceptions of vignette characters, particularly when the characters did not disclose an ASD diagnosis. These results may reflect social difficulties on behalf of the peer, as well as a potential affinity for others who openly endorse experiencing social difficulties.

261 **110.261** The Evaluation of Guidelines about How Teachers and Parents Can Use the Tablets Effectively for Supporting Children on the Autism Spectrum in the Area of Joint Attention Skills

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Background:
Despite the rapidly increasing use of tablets in schools and homes, and the children's motivation in using them, there is limited guidance on how to use the tablets to teach children with autism specific skills, such as joint attention skills.
Objectives:
This study was a follow up of four previous studies (teachers' and parents' interviews, classroom observations and focus groups) that led to the creation of guidelines for teachers and parents on how to use the mobile tablets with children with autism (aged 4-11) to support the development of joint attention skills. The aim of this study was to evaluate the content and structure of the guidelines as well as to investigate the usefulness of the documents and possible ways of disseminating them.
Methods:
Four group interviews were conducted in two primary schools and a HE institution comprised by researchers, teachers and parents. Each member of the group was given a copy of the two versions of the guidelines; one for parents and one for teachers.
Results:
Four major themes emerged from the analysis: 'The Content of the Guidelines', 'The Structure of the Guidelines', 'The Usefulness of the Guidelines for Parents and Teachers' and 'The Dissemination of the Guidelines'. The participants made recommendations on how the documents can be written to attract teachers' and parents' interest, what information they should include and how to be structured, and they also recommended activities that can foster joint attention skills in class and home. It was also mentioned that the guidelines can be a valuable tool for teachers to reflect on their practice and try new activities, as well as to use them with parents at school to build their confidence. Participants have not seen such a document before and mentioned that the guidelines can contribute to the teachers' professional development on how to use a tablet to teach joint attention skills to children with autism.
Conclusions:
The guidelines include recommendations based on the participants' input as well as evidence-based strategies on how to gain and maintain the child's attention, encourage sharing and turn-taking, initiate and sustain conversation, keep eye contact and empathise with others. It is argued that teachers can learn to use the tablets in an experiential, playful and intuitive way as long as they are aware of the purpose of using tablets in their classroom. The tablet has a supporting role to the learning and teachers as well as parents should use their expertise and knowledge of the child's needs and interests to teach them specific skills.

262 **110.262** The Impact of Socioeconomic Status and Parental Education on I-E Behaviors and Coping Skills in Children with ASD

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Background:
The presence of internalizing and externalizing (I-E) behaviors has been shown to negatively affect developmental trajectories in children (Slopen et al., 2013). Coupled with a diagnosis of Autism Spectrum Disorder (ASD), the presence of I-E behaviors in children may further complicate developmental milestones (Woodman et al., 2016). It has been reported that coping strategies and coping competence play a moderating role on I-E behaviors in neurotypical children (O'Leary-Barrett et al., 2013), suggesting coping may be an important intervention target. However, the relationship between coping skills andÂ I-E behaviors in children with ASD remains largely unexplored.
Objectives:
To explore the relationship between coping skills and I-E behavior presentation in children with ASD, while considering the moderating role of SES and parental education.
Methods:
Participants included 2,751 children (2,384 males, 375 females) aged 4 to 17 years, 11 months (M= 9.03, SD= 3.56) from the Simons Simplex Collection with data regarding coping skills and I-E behaviors. The coping scores from the Vineland Adaptive Behavior Scales -2nd Edition (Sparrow et al., 2005) were used as a measure of coping ability and Internalizing and Externalizing behaviors were captured with the Internalizing and Externalizing Symptoms T scores, respectively, from the Child Behavior Checklist (1.5-5 years and 6-18 years collapsed; Achenbach et al., 2001). SES and parental education were extracted from the demographic information for each family. Regression analyses were computed to assess the relationship between the child's coping skills and severity of I-E behaviors, with SES and parental education as potential moderating variables.
Results:
Similar to what is reported in the neurotypical literature, coping skills were negatively correlated with externalizing (r= -.306, p= <.01) and internalizing (r= -.052, p= <.01) behaviors in this large sample of individuals with ASD. SES was positively correlated with coping skills (r= .079, p= <.01), although parental education was not. SES was negatively correlated with I-E behaviors (internalizing r= -.095, p= <.01; externalizing r= -.129, p= <.01) and parental education was as well (maternal-internalizing r= -.064, p= <.01; maternal-externalizing r= -.085, p= <.01; paternal-internalizing r= -.056, p= <.01; paternal-externalizing r= -.059, p= <.01). When SES and parental education were entered into the regression equation, the significant relationship between coping and I-E behaviors both remained (internalizing r= -.052, p= .02; externalizing r= -.304, p= <.01), with SES playing a significant moderating role between coping skills and behavior (internalizing r= -.094, p= <.01; externalizing r= -.127, p= <.01). Parental education did not have a significant moderating influence.
Conclusions:
The observed relationship between coping skills and I-E behaviors in children with ASD, mirrors findings reported in neurotypical children. However, we found that SES plays a moderating role, such that at higher SES levels, the relationship between coping skills and I-E behaviors is stronger. Importantly, this observed relationship highlights the development of coping skills as a key target area of behavioral intervention that may benefit children with ASD and highlights that consideration of SES for interventions focusing on coping skills is essential.

263 **110.263** The Problem of Bullying: Parent, Teacher, and Layperson Perceptions

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Background: Bullying is a common problem in school-age children, and children with Autism Spectrum Disorder (ASD) are victims of bullying more frequently than their typically-developing peers (Kloosterman, Kelley, Craig, Parker, & Javier, 2013; Zeedyk, Rodriguez, Tipton, Baker, & Blacher, 2014). Although bullying and victimization behaviors have been examined in children with ASD, definitions vary across studies (e.g., Bitsika & Sharpley, 2014; Cappadocia, Weiss, & Pepler, 2012). As there is no precise definition of bullying or list of criteria for its occurrence (Humphrey & Hebron, 2015), perception and understanding of bullying may vary widely in the population. Conceptualization differences contribute to discrepancies in the literature regarding prevalence estimates and variables associated with bullying and victimization experiences (Humphrey & Hebron, 2015).
Objectives: This study aims to establish a more comprehensive understanding of bullying perceptions by identifying scenarios that exemplify this behavior, and characterizing them according to different types of bullying (e.g., physical, verbal, interpersonal, cyber). Additionally, this project seeks to identify differences in perceptions across types of bullying and ages of children experiencing bullying. Finally, this study aims to compare severity ratings for and identification accuracy of bullying scenarios by parents of children with ASD, service providers for children with special needs, and laypersons.
Methods: This study presents written vignette scenarios in an online survey format that describe various bullying and victimization interactions, and non-examples, between two school-age children (i.e., 4-15 years old). Participants include parents of children with ASD, service providers for children with special needs and laypersons (e.g., undergraduate college students).
Results: Data collection is ongoing; preliminary results from laypersons (N=313) indicate that respondents are able to discriminate between bullying and non-bullying examples ($t(312)=67.15$, $p<.001$), and vary significantly in their severity ratings of different types of bullying presented in the vignettes (Physical > Cyber > Interpersonal > Verbal; $F(2.92,911.14)=120.67$, $p<.001$). Respondents are frequently able to correctly identify the presence of bullying (M=73.96% accuracy, SD=12.44%), and vary in their accuracy of identifying types of bullying (Cyber > Verbal = Physical > Interpersonal; $F(2.58,705.52)=23.53$, $p<.001$). Finally, respondents rate bullying behavior more severely in older children in comparison to younger children (4-6yrs < 7-9yrs < 10-12yrs < 13-15yrs; $F(2.92,875.56)=30.217$, $p<.001$). Additional planned analyses include comparison of severity ratings and accuracy of responses by participant group. Completion of data collection is anticipated by December 2016.
Conclusions: The broad abilities of participants to distinguish between examples of bullying and non-bullying, and also to accurately identify the presence of bullying are promising for implementation of interventions. However, variation in accuracy in identifying, and severity perceptions of, different types of bullying highlight the need for precision in assessment because it informs intervention for bullying in school-age children with ASD. Additionally, bullying behavior may be overlooked, especially in very young children. Further conclusions may be drawn according to hypothesized group-level differences, especially regarding perceptions of caregivers and service providers for children with ASD.

264 **110.264** The Relationship Between Executive and Social Functioning in Children with Autism Spectrum Disorders on Parent-Rated Measures

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Background: Executive function (EF) deficits are common in children with Autism Spectrum Disorders (ASD), but not part of the diagnostic criteria. While both social and EF deficits in ASD have been extensively studied separately, there has been limited research on the *relationship between* EF and social function. Most research has focused on neuropsychological assessment of EF and/or how EF impairment is related to a diagnosis of ASD.
Objectives: The aim of the present study was to explore the relationship between social functioning and EF on parent-rated measures in a clinical sample of children with ASD. Furthermore we wanted to investigate how IQ, gender and age influence the relation between EF and social problems. Most research within the ASD field is done on males, but some evidence suggests that females exhibit greater EF and social impairments than their male counterparts and we would like to examine this further.
Participants and Methods: The current sample comprised 86 children with ASD recruited from outpatient clinics between 2013 and May 2016 and assessed at age 6-18 years. Thirteen of the children (15.1%) had childhood autism, 1 had atypical autism (1.2%), 41 (47.7%) had Asperger syndrome and 31 (36%) had unspecified pervasive developmental disorder. Male:female ratio was 2.7:1. Twenty-eight of the participants (32.6%) had an attention deficit/hyperactivity disorder (ADHD) diagnosis in combination with their ASD. Autistic symptoms were evaluated using Autism Diagnostic Interview-Revised (ADI-R) and/or Autism Diagnostic Observation Schedule (ADOS). In addition, the assessment included a full medical and developmental history, physical examination, and IQ assessment. For measurement of social function the parent version of the Social Responsiveness Scale (SRS) was used. In order to assess executive function parents completed the Behavior Rating Inventory of Executive Function (BRIEF).
Results: A multiple regression analysis was conducted to identify the relations between SRS total score and age, gender, total IQ, BRIEF Behavior Regulation Index (BRI) and BRIEF Metacognitive Index (MI). This model significantly explained SRS total; $F(5, 80)=12.57$, $p<.001$, $R^2=.440$. Only BRIEF MI had a significant independent contribution to the prediction, $p=.001$. This result remained when the children with comorbid ADHD where removed from the analysis. For the children with ASD without ADHD (n=58) the regression model with age, gender, total IQ, BRIEF BRI and BRIEF MI significantly explained SRS total; $F(5, 52)=10.31$, $p< .001$, $R^2=.498$. Only BRIEF MI had a significant independent contribution to the prediction, $p=.003$.
Conclusions: We report a relationship between parental reports of EF and social function in an everyday setting in children with ASD. We found that the metacognitive domain of EF has a significant association to many aspects of social function. These results may have implications for understanding the cognitive components in the social deficits that define ASD. The findings suggest that studies are needed to clarify if children with ASD will improve their social function through intervention programs designed to enhance EF in general and metacognitive function in particular.

265 **110.265** The Role of Callous- and Unemotional Traits in Emotional Face Processing in Adolescents with ASD or ODD/CD

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Background: Facial expressions are important for understanding others' emotions and feelings. Individuals with psychiatric disorders such as Autism Spectrum Disorder (ASD), Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD) show deficits in the processing of emotional faces. A common factor in these psychiatric disorders is the lack of empathy (Decety & Moriguchi, 2007). More recently, evidence pointed to a potential role of callous- and unemotional traits (CU traits) in emotional processing deficits in ASD and ODD/CD (Dadds et al., 2006; Leno et al., 2015). In ASD half of the adolescents show high levels of CU traits (Leno et al., 2015). In this study we used eye-tracking and questionnaires to compare facial emotion processing in adolescents with ASD, ODD/CD and typically developing controls (TDC), and examined the modulatory role of CU traits.
Objectives: Investigate the role of CU traits in gazing behavior towards emotional faces in a large sample of male adolescents with ASD, ODD/CD or typical developing controls.
Methods: A total of 122 male participants (N=42 ODD/CD, N=52 ASD, and N=28 (TDC) were included in the current study (age range: 12-19 years, mean = 15.4, SD = 1.9). We took a novel non-parametric trial-based approach to investigate the time-wise proportionality of looking behavior to specific regions of interest (ROIs) in emotional faces. As ROIs we selected the eyes region (both eyes within the ROI), the mouth region and the rest of the image. For every ROI we investigated total fixation duration, percentage of first fixation to ROI, and time to first fixation to a ROI in miliseconds. We used Kruskal Wallis one-way ANOVA to examine eye tracking patterns across facial emotions (neutral, anger, fear, sadness and happiness) and diagnostic groups. Furthermore, we investigated the correlation between eye gazing for emotional faces with CU traits by using the parent rated total scores of the Inventory of Callous-Unemotional Traits *(ICU)*questionnaire and the Youth Psychopathic Traits Inventory (YPI).
Results: We observed significant group differences for the time to first fixation towards the eye region for fearful faces using a Kruskal Wallis One-way ANOVA (X^2 (DF=2, N=248) = 6.11, p=0.0471). Compared to controls, the ASD and CD/ODD group took significant longer time to fixate on the eyes of a fearful face. For the mouth region we did not find significant differences. Moreover, for the other emotions and neutral facial expression we did not find significant group differences. When examining the role of CU traits we observed a significant positive correlation between time to first fixation for fearful faces and CU traits in both the ASD and ODD/CD group.
Conclusions: Our findings correspond with previous findings from eye-tracking studies that report deficits in the processing of fearful faces in both adolescents with ASD or ODD/CD. We were able to pinpoint more precisely eye-tracking gazing behavior in these clinical groups. Our data suggest that callous and unemotional traits play a modulating role in fear processing in both male adolescents with ASD or ODD/CD.

266 **110.266** The Sense of Leading Gaze in Joint Attention

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Background: Gaze plays a pivotal role in human communication, especially for coordinating attention. The Autism Spectrum Disorder (ASD) is considered to be strongly associated with impairments in joint attention. The ability to lead the gaze direction of others forms the backbone of joint attention. To be functional for interpersonal communication, this ability entails that the sensorimotor feedback yielded by the gaze reactions of others elicits a sense of leading gaze in the individual who initiates eye movements.
Objectives: This study investigates a specific aspect of joint attention in ASD, that is, the emergence of the sense that one is leading the attentional focus of others.
Methods: Using eye-tracking and virtual reality technology, we designed avatars that can follow the gaze of participants in real time. Seventeen adults with ASD and 17 typical adults matched on IQ participated. During a training phase, participants were alternately exposed to an avatar that followed their gaze and an avatar that moved its gaze independently from the participants. The avatars were surrounded by three objects that changed with each new trial (Figure). After each trial participants had to indicate what object they preferred and guess what object the avatar had preferred. In a subsequent test phase, they were facing the two avatars at the same time and three objects displayed around them. Again, one avatar was following their gaze while the other was not. The task was the same as before. Eye-tracking data served as measures of attention. Participants' responses regarding their preferred objects and the preferred objects of the avatars yielded a measure of their awareness that a link existed between them and one of the avatars, that is, the avatar following their gaze.
Results: Â During the final half of the training phase, typical participants selected the same preferred object for them and the gaze-following avatar more often than for the independently gazing avatar [*Z*Â =Â 2.08, *p*Â =Â 0.038]. By contrast, such an effect was not observed in the group with ASD. During the test phase, eye-tracking data yielded an interaction between the groups and the gaze behaviors of the avatars [*F*Â (1,Â 32)Â =Â 5.25, *p*Â =Â 0.029, η^2Â =Â 0.14]. Typical participants looked more at the independently gazing avatar than participants with ASD who were more focused on the gaze-following avatar.
Conclusions: Â Attentional measures suggest that participants with ASD continued to be intrigued by the gaze-following avatar during the test phase, while typical participants seemed to have already recognized the link between them and this avatar during the training phase. Impairments in joint attention could be linked to a failure in sensing oneself as an agent leading the attentional focus of others.
Figure: Snapshot of the virtual scene shown to each participant during the training phase. An avatar was displayed with three consumer goods located on its side and in front of it. The avatar either followed the gaze of the participant or displayed gaze patterns that were independent from the participant.

267 **110.267** Vicarious Effort-Based Decision-Making in Adults with Autism Spectrum Disorders

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Background: There has been recent emphasis on examining motivational aspects of social deficits in ASD (Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012). The purpose of the present study was to evaluate vicarious effort-based decision-making to address one aspect of the social motivation hypothesis of ASD (i.e., the willingness to expend effort to win a reward for another person). Our research group recently reported that adolescents with ASD are characterized by impaired vicarious effort-based decision-making (Mosner, Kinard, Mcweeny, Shah, Damiano, Burchinal…& Dichter, 2016).
Objectives: As a follow-up to our prior study of adolescents with ASD, the present study explored vicarious effort-based decision-making in adults with ASD to examine potential developmental changes in vicarious effort-based decision-making in ASD between adolescence and adulthood.
Methods: Twenty-three typically developing controls (TDCs; age *M*= 21.32, IQ *M*=118) and 28 high-functioning adults with ASD (age *M*=20.00, IQ *M*=107) participated. Diagnoses of ASD were confirmed with the ADOS-2, and groups were matched on age and gender distribution (*p*'s<.05). A modified version of the Effort Expenditure for Rewards Task (EEfRT) was used as a behavioral measure of vicarious effort-based decision-making. In this task, participants are provided with the probability of receiving monetary rewards of various magnitudes on each trial and asked to choose between an "easy task" for a small, stable reward or a "hard task" for a variable but consistently larger reward (Treadway, Buckholtz, Schwartzman, Lambert, & Zald, 2009).Â Unlike the standard version of the task where participants work to earn money for themselves, in this version of the task, participants were working to win money for another person.
Results: There were no group differences (ASD vs. TDC) in the proportion of hard task choices across all levels of reward magnitudes and probabilities (*p*'s>.05, Cohen's *d*<.27). There were also no significant Group x Magnitude or Group x Probability interactions (*p's*>.05, Cohen's *d*<.50). Effect sizes of this magnitude suggest results would remain non-significant with samples sizes as high as 67-270, depending on the effect examined.
Conclusions: Â These findings suggest that adults with ASD did not differ in their willingness to expend effort for others across all levels of reward probabilities and magnitudes compared to TDC adults. Contrary to our previous findings with adolescents with ASD, adults with ASD did not differ in sensitivity to reward parameters when earning rewards for others. These findings also contrast with our previous findings with adults with ASD, in which we found greater effort expenditure across all reward parameters when earning rewards for themselves compared to TDC adults (Damiano, Aloi, Treadway, Bodfish, & Dichter, 2012). The difference in patterns of results between the present study with adults and our prior results from adolescents (Mosner et al., 2016) highlights the developmental differences in vicarious effort-based decision-making for others. Adolescence may be an especially vulnerable period of development for individuals with ASD during which deficits in social motivation differ compared to adults. Future studies in this area should include younger children with ASD to further explore the trajectory of vicarious effort-based decision-making across development.

268 **110.268** Web-Based Tool to Assess Social Cognition in Youth with ASD: Reliability and Criterion Validity

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Background: Social cognitive deficits are a critical feature of autism spectrum disorder (ASD; Beauchamp & Anderson, 2010). However, no integrative, objective, psychometrically-sound tool to directly assess the multiple social-cognitive processes implicated in ASD is available. One such assessment, SELweb™, has demonstrated strong psychometric properties in large typically-developing (TD) samples (McKown et al., 2015). SELweb is an easy-to-use, web-based, modular assessment of self-control (SC), theory of mind (ToM), social problem solving (SPS), and emotion recognition (ER). If validated for youth with ASD, SELweb could complement outcome assessment batteries for intervention studies and provide a platform for a standardized social-cognitive assessment across settings.
Objectives: To evaluate (1) internal consistency of SELweb modules, (2) criterion validity of SELweb compared to existing social-cognitive measures, (3) SELweb performance in ASD youth compared to normative data, and (4) feasibility of using SELweb in this population.
Methods: Â Thirty-one youth with ASD (see Table 2 for demographics) completed the ADOS-2 (Lord et al., 2012), SELweb, and four validation tasks: Go/No-Go and Distractibility SC tasks (Zimmerman et al., 2005), an advanced ToM task (Happé, 1994), a SPS task (Kupersmidt et al., 2011), and a facial ER task (Tracy et al., 2009). Parents rated youth's social skills/problem behaviors (SSIS; Gresham & Elliot, 2008) and ASD severity (SRS-2; Constantino & Gruber, 2012). Cronbach's alpha was calculated to assess SELweb internal consistency. Pearson correlations examined associations of SELweb with demographic variables and scores on corresponding criterion measures and parent-reports. Independent-samples *t*-tests compared age-corrected SELweb scores to TD normative data. Qualitative feasibility data was collected during SELweb administration.
Results: Â Internal consistencies across SELweb modules were acceptable to excellent (α=.57–.91). SC, ToM, and SPS demonstrated convergent validity with criterion tasks (Table 1; all *p*<.011). SC correlation with the criterion SPS task evidenced discriminant validity (*p*=.188), as did ToM and SPS with criterion measures of all other SEL constructs (all *p*>.252). ER correlated with responses to angry faces on the criterion ER task (*r*=.398, *p*=.033). Youth who were older or male scored lower on ER and ToM (Table 2). Problem behaviors were associated with lower ER scores. IQ was positively correlated with SC, ToM, and overall SELweb scores. Youth who scored higher on SC or were younger took longer to complete SELweb. Youth with ASD scored significantly lower than the TD normative sample for SC, SPS, ToM, and overall (all *t*>2.35, *p*<.019). With one exception, all children completed SELweb and did so independently. As evidenced via comments and behavioral observations during testing, children were engaged with the assessment format. Only five children required one short break.
Conclusions: Promising psychometric properties and qualitative feasibility of SELweb support its utility as modular social-cognitive assessment for youth with ASD. SELweb performance corroborates well-established deficits among youth with ASD (SC, ToM, SPS) and converges with findings that ASD-specific differences in facial ER are inconsistent (Harms et al., 2010). Overall, SELweb demonstrates the capacity to acquire potentially treatment-sensitive, individual domain-specific profiles, in addition to overall, social cognitive functioning.

269 **110.269** Young Children's Understanding of Desires and Beliefs: Effects of Autism Spectrum Disorder and Modality on Theory-of-Mind

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Background: Â Theory-of-mind (ToM) abilities reflect a capacity to understand and react to thoughts and emotions in oneself and in others. Around age three years, many typically-developing (TD) children are able to reason about their own and others' mental states, particularly desires and beliefs. In contrast, children with autism spectrum disorder (ASD) and non-ASD developmental delays (DD) often show significant delays in mastering ToM skills (Baron-Cohen, Leslie, & Firth, 1985). However, there has been little research on the emergence of understanding desires and beliefs, the influence of modality on ToM performance, and the relationship of parent's perceptions of their child's ToM skills to ToM task-performance.
Objectives: Â We investigated 1) whether ASD and DD affect ToM performance in the auditory modality and the visual modality, and 2) whether parent's perceptions of their child's ToM abilities correspond with their child's performance on desire and belief tasks.
Methods: Â 42 three-year-old children (17 female) and parents were recruited for a larger project documenting the early development of communication and social understanding.Â There were three groups: ASD (*n*=13), DD (*n*=14), and TD (*n*=15) children.Â All children received four ToM tasks: two visual items adopted from Wellman and Liu's (2004) ToM scale assessing diverse desires and diverse beliefs and two newly-crafted auditory items also assessing desire- and belief-understanding.Â Parents completed the Theory of Mind Inventory (ToMI; Hutchins, Prelock, & Bouyea, 2014) from which we selected 6 items that focused on desires and beliefs. For each item, parents used a Likert scale ranging from 0 to 20 to indicate their child's ToM-understanding.
Results: Â Children with ASD (*M*=0.31, *SD*=.48) and with DD (*M*=0.50, *SD*=.76) passed significantly fewer ToM items than TD children (*M*=2.60, *SD*=1.06), $F(2,41)=35.13$, $p<.001$.Â The ASD and DD means did not differ significantly nor was there a significant effect of modality or a significant modality x group interaction. There was a significant association between group and the number of children who did not pass any ToM tasks, $\chi 2(2, N=42)=17.57$, $p<.001$. We found a significant difference in the average ToMI score by group, $F(2,41)=5.62$, $p<.007$, with no significant difference between parents of children with ASD (*M*=6.33, *SD*=4.94) or DD (*M*=7.18, *SD*=4.24), but significantly higher ToMI scores reported by parents of TD children (*M*=11.63, *SD*=4.49).Â ToM and ToMI scores were moderately correlated, $r(40)=.37$, $p=.018$.
Conclusions: Â Our findings suggest that three-year-old children with ASD or DD demonstrate significant delays in their desire-belief understanding compared to TD children across modalities, and that parent's perceptions of their child's understanding of beliefs and desires coincide with their child's performance on ToM tasks. Future studies should look at desire-belief understanding in older children with ASD and DD to document the developmental trajectories of these abilities and to investigate how children with ASD and DD might differ from TD children on other ToM constructs, such as knowledge/ignorance and false beliefs.Â Furthermore, additional research linking parent's perceptions of their child's ToM skills with children's performance on ToM tasks may inform the development of parent-mediated interventions that address social-cognitive developmental delays in children with ASD and DD

270 **110.270** "Friends Are Hard…but It Gets Better": An Examination of the Friendship Experiences of Adolescent Girls and Adult Women with and without Autism

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Background:
While much is known about the friendships and peer relationships of autistic children, these studies have focused largely on school-age boys on the autism spectrum. The very limited research on autistic girls' friendships intriguingly suggests, however, that they might be more similar to those of neurotypical adolescents than autistic boys.
Objectives:
This research sought to examine the friendship experiences of two cohorts of autistic females, adolescent girls and adult women, alongside their neurotypical counterparts, to elucidate the similarities and (subtle) differences across distinct stages of development.
Methods:
We conducted semi-structured interviews with 60 participants, including 30 from each age group (15 autistic girls, 15 neurotypical girls; M age = 14 years 2 months; M Social Responsiveness Scale (SRS) score = 83.8 autistic; 46.7 neurotypical) (15 autistic women, 15 neurotypical women: M age = 30 years 6 months; M SRS score = 78.3 autistic; 41.8 neurotypical). Thematic analysis was used to identify themes.
Results:
Almost all participants discussed having one or more secure friendship, although some autistic participants said that they had significant difficulty in maintaining relationships.
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Friendships online. Neurotypical girls used social media to display their offline friendships in the online environment, 'liking' friends' posts as a way of affirming the relationship. Autistic girls were at a severe disadvantage in terms of this 'friendship performance', as they often had limited access to social media and therefore could not engage in these reinforcing behaviours. In contrast, autistic women relied heavily on social media to enact their relationships, preferring written communication and often being active in online communities, making the internet an integral part of their social lives.
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*Competition.*Â Adolescents spoke of a sense of trying to 'be the best' in many different ways. This competition was within friendships as well as with wider peers. Autistic girls frequently described being unable to understand how to effectively engage in these behaviours, and therefore 'losing' social cachet. This competition during adolescence was mentioned by both autistic and non-autistic women in terms of past friendships, and that they actively avoid such people in adulthood.
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Conflict management. Â Autistic girls and women displayed a more 'extreme' social profile than their neurotypical peers, who generally sought to negotiate equitable outcomes when faced with conflict. In contrast, autistic adolescents felt they would either give up on the friendship or assume total responsibility for finding a solution, potentially leaving them vulnerable to manipulation. Similarly, autistic adults frequently said they would simply end a relationship that was difficult for them, leaving them happier and more satisfied with their social situation than they had been as a teenager.
Conclusions:
Despite identifying a wide range of challenges in the friendships of teenage autistic girls relative to neurotypical peers, these challenges tended to dissipate with age and maturity. Although adult autistic women acknowledged some continued social challenges, they generally described being highly satisfied with their friendships. Targeted interventions around self- and other-awareness may help autistic girls to identify and pursue the sort of relationships that would make them happiest.

271 **110.271** "My Brain Helps Me Think about Stuff": Autistic Children's Understanding of the Brain and Its Role in Behaviour

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Background: Very little is known about autistic children's knowledge of their own and other people's brains. The only existing study (Baron-Cohen 1989) suggested that autistic children have a relatively limited view of brain function, ascribing it with behavioural rather than mentalistic functions.
Objectives: Here, we sought to replicate Baron-Cohen's task and extend it to examine further children's perception of the brain and its role in shaping behaviour.
Methods: Cognitively able autistic (n=21) and neurotypical (n=39) children, aged between 6 and 11 years and of similar age and general cognitive ability, took part in structured interviews assessing knowledge of the functions of the brain and heart (cf. Baron-Cohen, 1989) and its perceived role in their own behaviour. We also used vignettes of neurodiverse children to prompt discussion (e.g., boys with possible autism, girl with possible autism, boy with possible ADHD) of the role of the brain in other people's behaviour.
Results: Contrary to Baron-Cohen (1989), we found no significant differences in the number of autistic and neurotypical children ascribing mentalistic functions to the brain. There was wide variability in children's responses, within both groups, ranging from full agency (e.g., "my brain was in control of making the right choice") to exerting influence (e.g., "it tells me to do things"). Both groups of children also identified the boys with possible autism and ADHD (but not the girl with possible autism) in the vignettes as not being personally responsible for their behaviour.
Conclusions: School-age children on the autism spectrum show a qualitatively similar conceptualisation of the nature of the brain and its functions to neurotypical children, contrary to previous suggestions. This study is the first stage of a fuller investigation of the way in which children on the autism spectrum understand their own brains and the role they play in shaping their distinctive identities.

272 **110.272** "If I Want to Live I Have to Camouflage": Social Camouflaging in Autism Spectrum Conditions (ASC)

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Background: Â One potential aspect of the female ASC phenotype is the phenomenon of 'camouflaging' – using deliberate and/or automatic techniques to mask characteristics of ASC as a way of coping in social situations. Camouflaging at school, home and in clinical settings may account for the large numbers of women and girls with ASC who do not receive a timely diagnosis or are diagnosed later in life. However, there has been little empirical research into camouflaging to produce a standardised construct. In addition, no research has yet explored camouflaging amongst males with ASC.
Objectives: Â To assess the camouflaging experiences of adults with ASC. This is the first study to investigate camouflaging in a large sample of adults of all genders with ASC, using a systematic, data-driven, qualitative research approach to produce a conceptual model of camouflaging.
Methods: Â As part of a larger online survey, 55 women, 30 men, and 7 other-gendered individuals aged 18-79 with ASC completed a series of open-ended questions about their camouflaging experiences (or lack thereof). Thematic analysis of responses was used to identify key themes relating to respondents' attitudes to camouflaging and its impact on their lives.
Results: Â The vast majority of participants (n = 79) reported camouflaging their ASC in some situations. Respondents viewed camouflaging as a useful tool to help them navigate the social world, but many regretted the need to change themselves in order to fit in. Some viewed camouflaging as deceitful and manipulative, or felt they had little control over their camouflaging behaviours. Physical, emotional and mental exhaustion was the main consequence reported, and this in combination with the more negative attitudes to camouflaging was reported to lead to mental health issues such as anxiety and depression. Some respondents also described camouflaging as a gendered concept, citing the higher social standards set for typically developing women and the common misperception of ASC as a 'male condition'. These were reasons why some respondents felt that female-presenting individuals were more pressured to camouflage than ASC men. Some female respondents felt camouflaging had hindered their ASC diagnosis or access to support.
Conclusions: Camouflaging is a real, meaningful experience in the lives of adults with ASC of all genders. The possibility of camouflaging needs to be considered when assessing individuals for ASC, especially women and girls.

273 **110.273** Using Eye Tracking to Examine Attention to Social Stimuli and Circumscribed Interests in Girls with ASD

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Background:
Recent research suggests that girls with ASD may differ in important ways from boys with ASD. Two areas of possible distinction include (1) Fewer and/or different restricted and repetitive behaviors (RRBs), particularly with regards to the content of circumscribed interests (CI; Hiller et al., 2015; Frazier et al., 2015); and (2) Greater social motivation (Dean et al., 2014, Sedgewick et al., 2016). Eye tracking studies have examined attention to social scenes/images and images of common CI (Chevalier et al., 2015, Sasson et al., 2008, 2011, 2014), however these studies included predominantly male samples and did not consider the potentially different behavioral phenotype of girls with ASD.
Objectives: Three validated eye tracking paradigms were modified to examine whether social and nonsocial attention differ in boys and girls with ASD.
Methods: ASD girls and boys ages 6-10 and typically-developing girls and boys matched on age and sex are currently being recruited. This abstract details data from 8 girls with ASD on three modified eye-tracking paradigms: 1) a series of visual search arrays that were modified to include *male, female* and *neutral* interest items. We present data from *male vs. female* slides; 2) attention to social images (faces) in the presence of competing object images [either CI or non-CI] measured using a modified paired preference paradigm (Sasson and Touchstone, 2014); 3) a series of social scenes based on the interactive paradigm of Chevalier and colleagues (2015). Scenes were modified to include different levels of sociability (solitary, parallel and dyadic play) and male and female objects. Results for this third paradigm are not reported here, but are anticipated by Spring 2017.
Results: In paradigm one, girls with ASD spent 61.85% of their onscreen fixation time on *female* images compared to 38.15% on *male* images (t=-3.89, p=.01). Girls with ASD explored a greater number of unique *female* images (6.5) than *male* images (5.3; t=-2.96, p=.04). Although overall attention in girls with ASD was less perseverative and detail-oriented than reported in previous studies of males (*Figure 1;* Sasson et al., 2008, 2011), trends emerged for attention to be more perseverative (800ms vs. 430ms; t=-2.23, p=.08) and more detail-oriented (more fixations per image; 1.8 vs. 1.37; t=-1.96, p=0.1) on *female* than *male* images. In the paired preference paradigm, girls with ASD focused more on social stimuli than objects, even in the presence of CI images, a finding that contrasts with boys with ASD (*Figure 2;* Sasson & Touchstone, 2014).
Conclusions: Our data suggest that girls with ASD may be more socially motivated and drawn to *gender typical* images, with social attention comparable to prior typically-developing samples. Although the current sample size is small, data collection is ongoing with an expected sample size of 40 by May 2017. Our data has the potential to reveal different attention patterns in girls with ASD that may serve as protective mechanisms by promoting higher social motivation and reduced perseveration on nonsocial images.

274 **110.274** Social Seeking Behaviour and Its Neurobiological Correlates

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Background: Evidence suggests that social stimuli are innately rewarding. The reward value associated with social stimuli motivates us to make effort to seek social contacts. The extent to which social stimuli are able to evoke behavioural effort may vary depending on neuro-biological reward responsiveness and individual differences in value assignment to social stimuli. A recent theory suggests that people with autism spectrum disorders (ASD) differ from typical people in their motivation to engage with others (Chevallier et al. 2012). Neurobiological evidence suggests that people with ASD may have differential processing of social stimuli than typicals. The tasks used to measure social motivation in these studies either focus on anticipation or visual preference for social stimuli. However, anticipation or visual preference are conceptually different from social seeking which is described as the behavioural effort made to engage with social stimuli.
Objectives: This research aims to evaluate social motivation in ASD conceptualized as social seeking i.e. process of making effort to engage with social stimuli. Furthermore, we aim to identify the neurobiological correlates involved in the act of choosing to engage in social interactions.
Methods: Â Choose a movie (CAM) paradigm is used to quantify social seeking. CAM measures the behavioural effort (key-presses) people make to look at social or non-social movies. On every trial a choice between stimuli is presented with different levels of effort. Hence participants constantly evaluate the value of social stimuli against effort. In study 1, we evaluated group of adolescents with (N=37) and without ASD (N=31) on CAM paradigm. In study 2, we tested 24 typical adults (13 males) on CAM paradigm while their neural activation was recorded using fMRI.
Results: Â Logistic regression was used to predict the role of stimuli, effort and their interaction on participants' decision to seek social stimuli. Results from study 1 showed that the social seeking behaviour of the ASD group was significantly influenced by the effort and stimuli, but not by their interaction. These results are similar to study 2, in which typical adults were also influenced by the effort and stimuli, but not their interaction. Our imaging results show significant activation in superior-parietal cortex, the area responsible for information integration, while participant made the decision to seek social stimuli. Imaging findings also suggest a significant correlation between strength of effort made to view social stimuli and activation in middle occipital cortex and post central sulcus, indicating differential cognitive processing for effort levels.
Conclusions: We extend the evidence supporting reduced social motivation in ASD. While people with ASD have lower social motivation, their tendency to seek social interaction may reduce further when higher effort is required. We also present evidence for the differential neural processing in typical adults for effort while seeking social engagement. Overall, our findings indicate that social seeking is a complex process that involves integration of information from various sources such as the subjective reward values and external factors e.g. effort. Each of these factors can influence the social seeking behaviours in people with ASD.

275 **110.275** Lack of Privileged Access to Awareness for Rewarding Social Scenes in ASD

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Background:
Reduced social motivation is hypothesised to underlie social behavioural symptoms of ASD (Chevallier et al., 2012). Evidence in support of this theory comes primarily from a) eye-tracking studies that commonly show reduced preferential looking to social compared to nonsocial stimuli, and b) differential neural responses to social rewards in individuals with and without ASD. Nearly all of these studies present stimuli above the threshold of awareness. This leads to an open question of whether such reduced preference for attending to social stimuli is seen if stimuli are presented below the threshold of conscious awareness. Continuous flash suppression (CFS) offers a method to test this possibility. A previous study has shown intact prioritisation of protofacial stimuli in autism using CFS (Akechi et al., 2015). However, this study does not explicitly test the difference between social and non-social stimuli, and uses schematic stimuli that are a) low in ecological validity and b) not rewarding.
Objectives:
To test whether individuals with and without ASD show earlier detection of social over nonsocial rewarding scenes that are closely matched for low-level stimulus features.. The measured variable is the time it takes for the target stimulus to overcome the interocular suppression induced by a dynamic mask. In line with the reduced social motivation hypothesis, it is predicted that neurotypicals will show a privileged access to awareness for rewarding social scenes, compared to ASD individuals.
Methods:
38 neurotypicals (11 males, mean age = 21.16) and 30 ASD adults (14 males, mean age =37.19) took part in the experiment. On each trial, a rewarding scene (social/nonsocial) was presented to one eye, and a high-contrast mask pattern updating at 10Hz was presented to the other eye. A control condition with inverted version of the same stimuli was similarly presented. Participants were required to indicate which side of fixation they 'detected anything other than noise'.
Results:
Mean response times were calculated from correct trials. The proportion of incorrect trials was comparable for both the two groups (3.46% for neurotypicals, 3.82% for ASD).
Since the groups were not matched on age, and in light of the known pitfalls of ANCOVA (Miller & Chapman, 2001), data from the two groups were analysed separately using Bayesian analyses (implemented in JASP). In neurotypicals, there was strong evidence for earlier detection of social reward over nonsocial reward stimuli (Bayes Factor [BF] = 839.87; this was not the case for the inverted condition, BF = 0.31). In ASD, there was moderate evidence for a null effect (BF = 0.23; also the case for the inverted condition, BF = 0.20).
Conclusions:
Strong evidence for a privileged access to awareness for rewarding social over nonsocial scenes was observed in neurotypical adults. No such privileged access was seen in ASD individuals, and moderate support for the null model was noted. These results suggest that the purported deficits in social motivation in ASD may extend to early attentional mechanisms.
Figure Legend:
Cumulative BF for upright social vs. non-social reward stimuli for neurotypicals (left) and ASD (right) individuals.

276 **110.276** Incentive Value of Social Signals in Typical Development and Autism.

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Background: Â It has beenÂ proposed thatÂ typicalÂ development ofÂ social orientingÂ is based on theÂ learningÂ of theÂ association betweenÂ 'engaging' social signals,Â such as positive emotion andÂ gazeÂ cueing,Â and subsequentÂ positive outcomes such as an enjoyable interaction or theÂ opportunity for social learning.Â By contrast,Â atypical social orienting in autismÂ couldÂ result from the difficulty toÂ learn such association,Â resulting in not assigningÂ the rewardÂ valueÂ to 'engaging'Â social stimuli.
Objectives: Â A novelÂ interactiveÂ eye-trackingÂ task was developed to investigate visual orienting towards social signals associated with a rewarding stimulus in typicalÂ developingÂ toddlers, children and adults as well asÂ inÂ children with autism.

Methods: Â A group of typically developingÂ toddlers (n = 32, 3-4Â years old) and a group of typical adults (n = 32, 18-45Â years old) (study 1) as well as two groups of typical and autistic children (n = 58, 6-18years old, study 2) completed the interactive eye-tracking task. The participants observed a stimulus display consisting of two peripherally presented dynamic social signals (faces) and a centrally presented reward. Participants' eye movements were concurrently recorded with an eye-tracker, and the location of participant's fixation triggered the delivery of corresponding stimuli on-line. Fixation on each face triggered a dynamic sequence of signals and subsequent delivery of a reward, which was a popular animated cartoon, or a penalty, a blank screen. Two types of social signals were presented. An engaging social signal consisted in a person greeting and turning towards the centre of the screen while the other non-engaging social signal consisted in a person moaning and turning away from it. Engaging social signals triggered reward delivery for half the participants of each group, and non-engaging social signals for the other half of the participants of each group.
Results: Preliminary analyses revealed that both typically developing toddlers and adults (study 1) and both groups of children with and without autism (study 2) were able to learn the association between either of the social signals and the subsequent reward delivery, and preferentially orient to the reward-predictive cues. Importantly, all the groups acquired stronger preference when the reward-predictive social signal was engaging than when it was non-engaging.

Conclusions: These preliminary results show that typically toddlers, children and adults as well as children with autism were able to learn the reward value of social signals (either engaging or non-engaging) when such signals were associated with a rewarding stimulus. Moreover, these studies showed that the engaging nature of social signals facilitates the learning of social signal-reward association both in typically developing children and in adults, as well as in children with autism. The implications of these findings are discussed.

277 **110.277** Reward Modulates Mimicry-Related Neural Response in Neurotypical but Not Autistic Individuals

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Background: Autism Spectrum Disorders (ASD) are marked by difficulties in forming social bonds. It has been hypothesized that diminished motivation to attend social stimuli because they are not perceived as rewarding might be causal to the deficits in social cognition observed in ASD (Chevalier et al., 2012). Differential reward processing might further be linked to the deficits in spontaneous facial mimicry as widely reported in ASD. While people with low autistic traits have been shown to spontaneously mimic happy faces more if they were correlated with higher reward, individuals with high autistic traits did not show such differential mimicry (Sims et al., 2012). In a recent study we further found that reward value impacts on mimicry-related neural response and that autistic traits modulate this impact in neurotypical individuals (Sims et al., 2014). However, this relationship has not yet been tested within a clinical sample.
Objectives: In this study, we investigate whether the learnt reward value of faces impacts mimicry-related neural response in people with Autism similarly as in typically developing (TD) controls.
Methods: 26 adults with ASD and 25 neurotypical adults, matched for age, gender, and IQ took part in this experiment. Neutral faces were conditioned with high and low reward value outside the scanner where participants won money during a virtual card game in the presence of some faces (high reward) and lost money in the presence of other faces (low reward) (similar to Sims et al., 2012). Subsequently, participants passively viewed videos of the conditioned faces (high vs low reward) smiling at them in a 3T fMRI scanner. Differential BOLD response to high vs low reward faces in the inferior frontal gyrus (IFG) as indicator of mimicry-related response (cluster identified through an independent meta-analysis of mimicry (Caspers et al., 2010)) was tested for group differences. Further, individual differences in this contrast [high>low reward faces] was tested for an association with self-reported autistic traits as measured by Autism Spectrum Quotient (AQ).
Results: Multiple regression analysis contrasting the response to high vs low reward faces revealed lower response in left IFG, in the ASD group compared to the matched control group (β_{group} = -1.88, p (1-tailed) = 0.033). Further, t-value of this contrast was negatively correlated with AQ across the whole sample (β_{AQ}= -0.3, p = 0.02).
Conclusions: Our results suggest that for individuals with ASD and high autistic traits mimicry-related brain response to smiling faces is less modulated by learned reward value when compared to TD controls. The result suggest that the translation of liking to increased spontaneous imitation might be reduced in people with ASD. Further, another previous study from our lab showed that being imitated by a face lead to less VS activity in people with ASD as compared to controls (under revision), indicating that the link between reward and mimicry is affected in both directions in ASD. The latter could be a potential mechanism underlying difficulties in building social rapport.

278 **110.278** Reduced Looking at Imitative Actions in Young Children with ASD

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Background:
Imitation is a fundamental component of social behaviour, and noted from early stages of human development. Atypical imitation has been reported in ASD in clinical and observational accounts. One hypothesis suggests that imitation serves to build social rapport due to its inherently rewarding nature. The rewarding nature of imitation is noted from neuroimaging evidence that shows increased activity in reward-related neural regions when participants are being imitated, or watching imitative vs non-imitative interactions (Kuhn et al., 2010; Kuhn et al., 2011). A recent study using eye-tracking and self-report demonstrated that individuals with low trait empathy showed a reduced reward value for imitation (Neufeld & Chakrabarti, 2016). These lines of evidence lead to the question of whether imitation carries a similar reward value for children with and without ASD. Reduced reward value for imitation might manifest in reduced attention to imitative actions, which in turn can have long-term consequences, since many essential skills including language and social learning relies on and benefits from imitative actions.
Objectives:
To test, using an eye-tracking experiment, whether children with and without ASD attend equivalently to videos of naturalistic imitative play.
Methods:
Fifty-one children (22 ASD, 29 typically developing children (TD), aged 29-93 months (ASD mean=57.5, SD=17.5; TD mean=60.2, SD=8.1) were enrolled in the study. TD children were recruited in two mainstream nursery schools in Messina, Italy. ASD children were tested at the clinical facilities within the National Research Council of Italy (CNR), Messina. The Autism Diagnostic Observation Schedule - Second Edition (ADOS-2) and the Griffith's Mental Development Scale (GMDS) were used as part of the diagnostic assessment.
The experiment consisted of 6 trials (4 toy activity videos, and 2 gross motor imitation activity videos) of a child and an adult imitating each other (4 actions each video) in a naturalistic play interaction, presented on a computer screen. Each trial lasted 25 seconds and was presented in a random order. Gaze patterns were recorded with a SMI iView XTM RED dark-pupil 120Hz eye-tracking system (Sensomotoric Instruments, 2005) and exported using SMI **BeGaze 2.4** software. Statistical analyses were conducted using R (http://www.r-project.org/). A linear mixed effects model (package: lme4) was applied to explore the effect of group, gender and age to predict looking time (dwell time), accounting for the random effects of the different trials and the different regions of interest (adult and child activity, adult and child face, background). Results:
A main effect of group was observed on the looking time to imitative actions (Wald chi square= 6.1, p = .01), lowering it by about 1.15 sec(SE=0.45 sec) in the ASD group. No significant effect of age and gender was found (Wald chi square= 0.99, p = 0.3 and Wald chi square= 1.6, p = 0.2 respectively).
Conclusions:
We found a significant group difference in the amount of time spent attending to the imitative activities, with the ASD children attending less than the TD children to the videos. This provides preliminary evidence of a reduced reward value for imitative actions in ASD.

279 **110.279** Patterns of Individual Change in Response to Reciprocal Imitation Training

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Background: Reciprocal Imitation Training (RIT) is a naturalistic developmental behavioural intervention targeting social imitation skills. Previous research has shown RIT to be effective in increasing spontaneous object and gesture imitation. In a recent replication trial of a previous pilot-RCT of RIT, our RIT treatment group demonstrated a significant increase in spontaneous play-based object imitation skills compared with a wait-list control group (Malik, 2016). Alternatively, we did not replicate previously observed gains in elicited imitation skills.
Objectives: The aim of the present study was to evaluate whether individual children in the treatment group demonstrated reliable change in spontaneous and elicited imitation skills, and to further examine response to treatment in relation to child characteristics.
Methods: Twenty-four children with autism participated in the pilot randomized controlled trial. Stratified randomization led to two well-matched groups of 12 children: Treatment and Wait-List Control. Primary change measures included an Unstructured Imitation Assessment (UIA) and a Structured Imitation Assessment (SIA). These measures were administered pre- and post-intervention. Mullen Scales of Early Learning (MSEL) and Autism Diagnostic Observation Schedule (ADOS) were administered to characterize the children. Twenty sessions of RIT were delivered to the Treatment Group.
Results: Reliable Change Index (RCI) was calculated for both the Treatment and Wait-List groups to explore individual patterns of change that might be associated with RIT. On the UIA, 4 children showed Reliable Change in the Treatment group. Closer inspection of individual data revealed that these were also the only children in the entire dataset who did not exhibit any unusual sensory interests or complex mannerisms on the ADOS. One child exhibited reliable change in spontaneous imitation skills in the Wait-List Control group. No child exhibited skill deterioration in the Treatment group, whereas one child in the Wait-List Control exhibited skill deterioration. One child improved reliably on the SIA in the Treatment group while no child in the Wait-List group demonstrated reliable change on the SIA.
In order to examine child characteristics associated with response to treatment, correlation analyses were conducted between spontaneous imitation change scores (UIA) and chronological age, non-verbal mental age, and verbal mental age (MSEL), and all ADOS domains. In the Treatment group, total spontaneous imitation change scores were negatively correlated with ADOS Reciprocal Social Interaction (r_s = - 0.67, p <0.01), and ADOS Stereotyped Behaviours and Restricted Interests (r_s = - 0.61, p = 0.01). In the Wait-List group none of the child characteristics were associated with change in imitation scores.
Conclusions: A greater percentage of children showed reliable improvements in the RIT treatment group (33%) as compared with the Wait-List Control group (8%). Findings from both RCI and correlation analyses suggest that children who had fewer self-stimulatory behaviours were more likely to respond to RIT. These findings support the efficacy of RIT for children with ASD, but also suggest that children presenting with greater social difficulties and/or greater stereotyped, repetitive behaviours may be less likely to benefit from RIT.

280 **110.280** Intuitive Cooperation in Autism

M. Brosnan *and C. Ashwin, University of Bath, Bath, UNITED KINGDOM*

Background:
Dual Process Theory of Autism (Brosnan et al., 2016) proposes that slower, deliberative (Type 2) processing dominates in people with a diagnosis of ASD, whereas rapid, intuitive (Type 1) processing typically dominates in the general population. Rand et al. (2012) propose that cooperation, as assessed through a 'donating' task, is enhanced through Type 1 processing (e.g. when forced to make a fast decision) and diminished under Type 2 processing (e.g. with more time to deliberate on the decision).
Objectives:
There were three objectives: 1) To replicate the 'fast-cooperation' effect; 2) To examine if autistic-like traits in the general population relate to cooperation (assessed through amount donated) and the fast-cooperation effect; and 3) To examine if a group on the autism spectrum differed from a typically developing (TD) control group on cooperation (assessed through amount donated) and the fast-cooperation effect.
Methods:
1) 154 participants from a university open day volunteered to undertake a 5-minute online task, and were randomly allocated to either a fast (decide within 10 seconds) or slow (think about the decision for at least 10 seconds) condition. The decision was to identify how much of 40p would be donated to a collective pot to be doubled and distributed equally amongst all group members (and how much was to be kept for themselves, see Rand et al., 2012). 2) This task was repeated with 53 (33M, 20F), 17 year olds, who also undertook an assessment of autistic-like traits. 3) This task was repeated with 29 people with ASD (20M, 9F) and 32 TD controls (17M, 15F) aged 17.
Results:
1) Mean Fast condition (n=83) = 29.35 (SD 10.60); Mean Slow condition (n=71) = 26.06 (SD 13.00); $t(134.991)=1.71$, $p<.05$; Cohen's $d = .28$. The effect was significant, but small (around 8%), and in line with prediction.
2) A Linear Regression revealed that greater autistic-like traits were a significant predictor of a lower amount donated (Beta= -.34, $p<.02$) but condition (fast/slow – the effect was 5%) and sex (male/female) were not (both $p>.05$).
3) An ANOVA with amount donated as the dependent variable with Diagnosis (ASD/TD) and condition (Fast/Slow), and sex as a covariate revealed no significant relationships (all $p>.05$). Examining the insignificant trends, the ASD group donated around 8% less than the TD group in both conditions, see Figure 1.
Conclusions:
There is a relatively consistent effect in the manipulation of co-operation (around 8%) which may be affected by the speed of presentation (consistent with Rand et al.) or level of autistic-like traits (consistent with Brosnan et al.) – but these variables do not interact with each other. It would seem that those with ASD are as susceptible to the fast-cooperation effect as the TD group. Taken as a whole, the patterns in the data would suggest that higher autistic-like traits (including a diagnosis of ASD) are associated with less cooperation (8%, as measured by this task) and are as equally susceptible to the effects of time pressure as comparison groups.

281 **110.281** Preserved Socio-Economic Decision Making in Autism Spectrum Disorder: Evidence from the Ultimatum Game

***A. M. Acosta Ortiz**, S. Reimers and S. B. Gaigg, Psychology, City, University of London, London, United Kingdom*

Background: Game theoretical tasks have contributed significantly to our understanding of the role of intuitive and more deliberative reasoning processes in social decision making. One of these tasks is the Ultimatum Game (UG; Fehr & Schmidt, 2006), in which a proposer can decide how to split a given amount of money (£10) between themselves and a responder who then has the opportunity to either reject or accept the offered amount. If the responder accepts, the money is paid out as proposed; if s/he rejects neither participant receives any amount. The UG reliably demonstrates that social-economic decisions are primarily governed by relatively intuitive pro-social motives rather than rational thought. Thus, proposers commonly offer equal shares and responders tend to reject offers below 30%, when it would be rational for the proposer to offer the minimum amount possible under the assumption that a rational responder would accept something over nothing *(Fehr & Schmidt, 2000).* The difficulties that individuals with ASD demonstrate in various aspects of social cognition, coupled with their relative strengths in rule-governed and analytical thinking, would lead to the prediction that decisions on the UG by individuals with ASD would be based relatively more on deliberative thought than social-emotional intuition.
Objectives: To test the above prediction by examining the effects of time pressure on decision making in ASD on standard and modified versions of the UG that require either a standard reject/accept decision of offers or a calculation of whether more or less than 30% has been offered.
Methods: 23 ASD and 23 age and ability matched TD adults completed a multi-trail UG in which 48 offers were presented that varied across four levels of fairness (50%, 40%, 25% or 20% of varyingly sized pots). On two blocks participants needed to make standard accept/reject decisions, either under a 1.5 second time limit or no time-limit. On another two blocks, participants needed to indicate whether they were offered more or less than 30% of the total pot, again either under time pressure or not. Finally, participants completed the cognitive reflection task (CRT; *Frederick, 2005)*, which provides a measure of how likely people are to override instinctual responses with reflective thought.
Results: A significant Task x Time pressure interaction showed that time pressure significantly impacted on participants' ability to indicate whether offers were more or less than 30% without any significant effects on rejection rates. The absence of any group differences, suggests that both individuals with and without ASD reject offers more on the basis of an instinctual reaction rather than a rational calculation, which was further supported by inverse correlations between rejection rates and CRT even when overall accuracy on the mathematical calculation task was statistically controlled.
Conclusions: Contrary to predictions, the results suggest that individuals with and without ASD rely on similar intuitive, rather than deliberative processes to formulate decisions in the UG. The results will be discussed in light of additional evidence which suggests few differences in how individuals with and without ASD form decisions on the UG.

282 **110.282** How Accurate Are Adults with Autism in Gauging How Their Personality Traits Are Evaluated By Others?

***N. J. Sasson**[1], A. Pinkham[2], D. J. Faso[3], K. E. Morrison[2] and M. Chmielewski[4], (1)University of Texas at Dallas, Richardson, TX, (2)The University of Texas at Dallas, Richardson, TX, (3)University of Texas at Dallas, Allen, TX, (4)Southern Methodist University, Dallas, TX*

Background: Adults with autism spectrum disorders (ASD) are characterized by impairments in social cognition that contribute to social dysfunction (Sasson et al., 2011). Reduced understanding of the views and mental states of others in ASD (Happe, 1994) may result in a failure to adjust social behaviors depending upon the perceived expectations and knowledge of a social partner.
Objectives: The current study examines whether adults with ASD are less accurate than typically-developing (TD) controls at evaluating how their personality traits are viewed by others. We predicted that the ASD and TD groups would not differ on the self-perception (SP) of their personality traits or on how they expected others to perceive them (EOP), but they would differ on how unfamiliar others actually perceive them and on the accuracy of their EOP.
Methods: 412 undergraduates (294 female; M age = 20.2) rated videos of 11 adults with ASD (8 male; M age = 26.5) and 11 matched TD controls (8 male; M age = 25.9) on 20 personality traits drawn from the Big Five and autism-related questionnaires. The videos depicted ASD and control participants completing the "High-Risk Social Challenge Task" (Gibson et al., 2010) in which they make a one minute "pitch" for why they should be hired for a reality television program. ASD and control participants also rated themselves (SP), and how they thought someone would rate them upon their first meeting (EOP), on the same 20 personality traits.
Results: Averaged across the 20 traits, the ASD and TD groups did not differ in how they rated themselves ($F(1,20)=.17$, $p=.684$), or how they expected to be rated ($F(1,20)=.01$, $p=.937$). For individual traits, they differed only on the ASD group having a higher SP and EOP rating for creativity, and the TD group having a higher SP rating for being organized. However, undergraduates rated the ASD group less favorably than the TD group both overall ($F(1,410)=1823.56$, $p<.001$), and on every trait after correcting for multiple comparisons (corrected alpha=.0025) except for being quarrelsome. The ASD group was also less accurate at predicting how they would be rated. The discrepancy between their EOP and how they actually were rated was larger than for the TD group, both overall ($F(1,411)=1519.86$, $p<.001$), and on every trait after correcting for multiple comparisons, except for being more accurate on stubbornness and disorganization.
Conclusions: Although the ASD and TD groups largely did not differ on their self-perception of their personality traits or on how they expected others would perceive them, unfamiliar third party evaluators perceived the TD group more positively than ASD group. Further, the ASD group was far less accurate at predicting how they would be perceived than the TD group. Such inaccuracies may specify a potential mechanism through which reduced social cognitive ability may contribute to social impairment for adults with ASD.

283 **110.283** The Neural Bases of Social Motivation in Autism Spectrum Disorder during a Real-Time Peer Interaction

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Background: Difficulties with social communication and social interaction, including reduced interest in both approaching and sharing information with peers, are core features of autism spectrum disorder (ASD). Some hypothesize that reduced social motivation in ASD is one cause of these social communication deficits. However, functional magnetic resonance imaging (fMRI) studies investigating the neural correlates of social motivation in ASD reveal inconsistent findings. Critically, these past paradigms do not involve social *interactions*, which is a core area of dysfunction in ASD. Rather, participants are asked to passively and independently view images (e.g., static photos of smiling faces), which may not approximate real-world social communicative contexts. This lack of reciprocal social interaction and real-world applicability is troubling since individuals with ASD have the most difficulty in interactive social communicative contexts but may perform within normal limits on non-interactive laboratory tasks related to social cognition (Schilbach et al., 2013; Senju et al., 2009).
Objectives: Â The purpose of this study was to utilize a real-world interactive fMRI paradigm to investigate neural circuitry underlying social motivation in ASD.
Methods: Â Twelve children with ASD (ages 9-14, one female) and eleven gender-matched NT children (ages 8-12) were informed they would be chatting online both with a peer and a computer. The chat was simulated, but all children believed that the peer was real. Each trial had two phases: Initiation, in which participants disclosed information about themselves (e.g., "I like sushi") and Reply, in which participants received feedback from the peer ("Me too/neither!") or computer ("Matched!").
Results: Â During the Initiation period, neither NT nor ASD participants showed differences in activation between initiating a conversation with a peer versus a computer at the whole brain level (all whole-brain results are given at $p<0.01$, k = 20), potentially due to the high reward value of self-disclosure regardless of recipient. However, during the Reply period, NT participants showed greater activation in amygdala, ventral striatum (VS), orbitofrontal cortex (OFC), medial prefrontal cortex (mPFC), superior temporal sulcus (STS), and temporoparietal junction (TPJ) when they believed they were receiving a reply from a peer versus a computer, while participants with ASD showed no significant differences to peer versus computer replies. Between-group (NT versus ASD) whole-brain and region of interest (VS and amygdala) analyses revealed no significant differences between groups in neural activation to peer versus computer in either the Initiation or Reply phases; however, this may have been due to the current small sample size. These findings are preliminary, and data collection is ongoing.
Conclusions: In summary, preliminary results suggest that neurotypical children, but not children with ASD, show greater activation in classic reward and social cognitive brain regions when interacting with a same-aged peer (versus a computer control). The investigation of neural and behavioral correlates of social motivation within real-time social interactive contexts will help us better understand the core social deficits in ASD as well as typically developing children's drive to orient to and interact with the social world.

284 **110.284** Caregivers and Their Children with Autism Reading Together

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Background:
Experts have stressed the importance of including language and early literacy instruction as part of early intervention programming for children who are at-risk for reading difficulties but our understanding of literacy skill development for children with autism remains under-addressed in research and practice. Shared book reading interventions are well-studied approaches for bringing about change in language and early literacy with the additional benefit of being highly valued by both caregivers and early childhood professionals. To maximize the potential for shared reading, there is a critical need for research to be conducted in homes of children with autism to identify factors that can promote or inhibit shared reading experiences.
Objectives:

- To examine the extent to which children with autism actively participate in shared reading activities with their caregivers.
- Discuss challenges around participant recruitment and launching a program of research as a recently transplanted early career scholar.

Methods:
We used a quasi-experimental group design to study shared reading interactions of caregivers reading to their typically developing children (*N*=20) and caregivers reading to their children with autism (*N*=18). Caregivers read a total of nine books to their preschool-age child: preferred books selected by the child and/or caregiver from their personal library; unfamiliar fictional books; and unfamiliar non-fictional books. All reading sessions were videotaped to allow research assistants to code videos for the quality of joint engagement during book readings. Children's levels of engagement during book reading sessions were measured using continuous time sampling. Definitions of engagement have been adapted specifically for book reading from previous work on joint attention (Adamson, Bakeman, & Deckner, 2004; Wong & Kasari, 2012).
Results:
Our preliminary analyses reveal that children with autism spent more time unengaged (9.5%) in reading compared to typically developing children (3.4%). In addition children with autism demonstrated more frequent behaviors that disrupted reading sessions (3.3%) compared to their typical peers (1.7%). Typically developing children spent the majority of book reading in a passive engagement state (63.4%; e.g., listening to the caregiver read) followed by joint engagement (29.8%; e.g., making comments, responding to questions). Children with autism spent less time passively engaged (47.7%) and more time jointly engaged (38.1%) compared to typically developing children. Analyses of factors that may influence child engagement, specifically book type (familiar, non-fiction; fiction) and quality of parent book reading, are forthcoming.
Conclusions:
Shared book reading requires that children are able to sustain social interaction around a particular book, which can be challenging for many children with ASD due to difficulties with social communication and joint attention. These preliminary findings suggest that engagement in shared reading is both qualitatively and quantitatively different for children with autism compared to typically developing children. Additional analyses are forthcoming that will allow us to identify malleable factors that can promote or inhibit shared reading experiences, which may serve as targets for future intervention.

285 **110.285** Environmental Impacts on Language Development of Young Children with ASD

***J. B. Plavnick**, Michigan State University, East Lansing, MI*

Background:
Vocal language development of children with autism spectrum disorders (ASD) is an essential component of early intervention programs (Goldstein, 2002; Norrelgen et al., 2015), yet collecting representative language data can be difficult. Standardized direct assessments of children's language may be impacted by fluctuations on a given day, particularly for children with more severe ASD symptoms. Language samples obtained across time in the participant's natural environment provide a more complete account of language development and environmental effects on language (Kasari, Lord, & Tager-Flusberg, 2013; Tager-Flusberg et al., 2009). However, these samples require extensive time and money to collect.
Objectives:
The purpose of this study was to assess the language development and environmental impacts on language of young children with ASD enrolled in an early intensive behavioral intervention program. The Language ENvironment Analysis (LENA) system was used to collect and analyze weekly language samples of children with ASD. Gains in vocalizations and conversational turns will be assessed. In addition, correlations between environmental variables (e.g., instructional ratios, locations in center, activities) and vocalizations of children with ASD will be examined.
Methods:
Language samples of 16 children with ASD enrolled in an early intensive behavioral intervention program were collected twice a month over an eight-month period using the LENA Digital Language Processor and analyzed using the LENA software. Recording sessions lasted approximately 6.5 hr for each child at each time point. Child vocalizations, adult word count, and conversational turns between the child and adults were extracted for analysis. Paired samples t-tests were used to assess for differences in dependent measures at pre and post. Researchers also collected participants' daily activity schedules to correlate environments and activities with frequencies of child vocalizations, adult words, and conversational turns between adults and children.
Results:
Preliminary results indicate high within participant variability in frequency of vocalization and conversational turns between adults and child participants. During a given day, children appear to demonstrate higher vocalizations during group activities, with fewer vocalizations during one-to-one instructional programming. A complete description of correlations between environment and dependent variables will be presented.
Conclusions:
The results suggest variations in activities and instructional programming can impact the language of children with ADS. The LENA processor and software allow for an economical collection of language samples, which can reveal patterns in behavior across environments. By identifying environmental variables associated with high and low language levels, it may be possible to construct educational and therapeutic environments that are more meaningful for children with ASD.

286 **110.286** Function-Based Intervention with E-Coaching in Reducing Challenging Behaviors during Home Visits

***A. Fettig**, University of Massachusetts Boston, Boston, MA*

Background:
Challenging behaviors present a significant barrier to learning for children with disabilities and are a source of stress for families and practitioners. Extensive research has shown that function based interventions (FBI) are effective for reducing challenging behaviors and increasing pro-social behaviors in young children with disabilities, including Autism Spectrum Disorder (Duda et al, 2008; Fettig, Schultz, & Sreckovic, 2014). Studies that compared FBI to non-function based interventions have noted distinct advantages of this approach (Ingram, Lewis-Palmer, & Sugai, 2005). Research also demonstrated that follow-up coaching and support were *necessary* for ensuring high fidelity implementation (Barton & Fettig, 2013). Across this literature, coaching of FBI generally involved face-to-face meetings and multiple home visits. This is costly and time and resource intensive, which might limit the amount of support practitioners receive. Few have examined the use of web-based technology (videoconferencing, texting, emails) to support practitioners (Ludlow & Duff, 2002), and this might be a feasible approach. To date, no FBI studies have examined effects of videoconferencing to support interventionists to implement intervention during home visits. Given the need for cost effective and accessible approaches, a logical next step is to investigate effectiveness of e-coaching for supporting implementation of FBI with children with disabilities and challenging behaviors.
Objectives:
This study explored the effects of an e-coaching approach within FBI for an early interventionist working with a toddler with ASD and challenging behaviors. The research questions were: was e-coaching functionally related to the interventionist's implementation of FBI and was high fidelity of implementation of FBI related to a decrease in the child's challenging behaviors.
Methods:
The target behaviors for this study were: interventionist's implementation of FBI, missed opportunities for use of strategies and child challenging behaviors. The FBI was derived from the individualized behavior support plan (BSP) created with the parents and the interventionist. The BSP included strategies that supported interventionist in preventing challenging behaviors (e.g. visual cues for transition), teaching the child new skills (e.g., prompt child to ask for help) and responding to challenging and appropriate behaviors (e.g., redirection and praise).
Single subject, multiple baseline across behaviors design (Kazdin, 2011) was used to examine changes in the interventionist's use of FBI with the introduction of e-coaching. E-coaching via Facetime™ was introduced with the first set of FBI strategies (prevention) demonstrating baseline stability following the training sessions. Once the first behavior demonstrated stability with e-coaching, e-coaching commenced with the next set of strategies (teaching new skills and then responses to behaviors) to demonstrate baseline stability.
Results:
The results indicated that e-coaching was effective in supporting early interventionist's implementation of FBI and high fidelity of implementation resulted in reduced child challenging behaviors. Social validity data as well as research and practice implementations will also be shared.
Conclusions:
Given the study results and the need for cost effective and accessible approaches, educators should consider using e-coaching to support the implementation of FBI with children with ASD and challenging behaviors.

287 **110.287** The Transformative Learning Experiences of Parents during Parent Education Groups

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Background:
Many parents of children with ASD have opportunities to participate in parent education groups. While focusing primarily on knowledge and skill acquisition (Schultz, Schmidt, & Stichter, 2011), these programs offer natural opportunities for dialogue and group support for parents with similar needs. Parent groups have potential for facilitating transformative learning through critical reflection on parent practices, discovering new perspectives and insights, and acting on new learning through changes in patterns of parenting (Wolfe, 2001; To, 2013). However, it is not yet understood how parents of children with ASD experience parenting groups and the potential for transformative learning within these contexts.
Objectives:
What were the potential and critical factors for fostering transformative learning experiences of parents of children with ASD participating in parent education groups?
Methods:
In order to better understand the transformative potential of such an education group, interviews were conducted with 17 parents who completed a parent education group (SCI-P) for parents of children with ASD. During the interviews, experiences of transformative learning and how group facilitation hindered or supported such learning were explored. Interviews were recorded and transcribed. Transcripts were coded through an iterative, collaborative process using a constant-comparative approach (Lincoln & Guba, 1985) that progressed from open coding using NVIVO (2012) software, to two additional passes across interviews using codes emerging from literature and research team discussions, to the development of matrices to further identify consistencies and discrepancies across participants (Huberman & Miles, 1994; Strauss & Corbin, 1998). Finally, themes were developed to answer the research questions and are described in the following section.
Results:
Two major themes emerged from the data. First, parents reported perspective shifts, which empowered them to act and think differently. Parents identified three areas in which they reframed how they thought: characteristics of ASD, their child's potential and parent actions, and being alone. The second major theme parents discussed was the impact the group characteristics had on their experience. Specifically, they were affected in positive ways by the openness of the group, the similarities they had with other parents, and the differences they had from other parents.
Conclusions:
Facilitators of parent groups are unlikely to recognize the potential for transformative learning for parents of children with ASD, given the limited research of transformative learning in informal, applied educational settings outside of higher education or the workplace (Taylor, 2007). Based on this study, facilitators should consider the value of promoting transformative learning given the various forms of perspective shifts and possible outcomes. They should incorporate ways to support the transfer of this learning into daily lives. The critical role relationships between and among the parents held for learning, suggest facilitators must integrate approaches to encourage and nurture relational spaces which are open and safe. Additionally, the importance of diversity in parenting experiences that resulted in disorienting questions and insights suggest facilitators should consider criteria for group participation (e.g., time since diagnosis).

Oral Session - 1A
112 - Prevalence, Trajectories and Treatment of Medical and Psychiatric Comorbidity
1:45 PM - 2:35 PM - Yerba Buena 3-6

Session Moderator: Bryan King, *UCSF Department of Psychiatry, University of California, San Francisco, San Francisco, CA*

1:45 **112.001** Medical Conditions in the First Years of Life Associated with Future Diagnosis of ASD in Children

L. A. Croen[1], *S. E. Alexeeff*[2], *V. Yau*[3], *Y. Qian*[2], *M. N. Davignon*[4], *P. M. Crawford*[5], *F. Lynch*[5] *and R. L. Davis*[6], *(1)Kaiser Permanente Division of Research, Oakland, CA, (2)Division of Research, Kaiser Permanente Northern California, Oakland, CA, (3)Kaiser Permanente, Berkeley, CA, (4)Kaiser Roseville Medical Center, Roseville, CA, (5)Center for Health Research, Kaiser Permanente Northwest, Portland, OR, (6)Department of Pediatrics, UTHSC, Memphis, TN*

Background: Many children with ASD have co-occurring medical conditions. However, large scale epidemiologic studies of health conditions emerging in the period preceding the first ASD diagnosis are lacking. Earlier ASD diagnosis and treatment can reduce the degree of impairment and improve function, thus identifying factors that precede a future ASD diagnosis could be immensely useful. If particular conditions are associated with future ASD diagnosis, ongoing surveillance of these conditions might aid in screening for ASD, enabling earlier identification and treatment.
Objectives: To examine medical conditions diagnosed prior to the first ASD diagnosis, assessing their prevalence and associations with subsequent ASD diagnosis.
Methods: The study population was drawn from the population of all children born from 2000-2009 and continuously enrolled in Kaiser Permanente (KP) in Northern California, Georgia, and the Northwest for the first two years of life. Data from electronic medical records (EMR) were reviewed through June 2012. We used a matched case-control design and included medical conditions documented prior to the first ASD diagnosis (N=3,911) or the matched age for controls (N=38,609). Over 1,000 ICD-9 codes were grouped into 79 medical conditions (e.g., constipation) within 19 domains (e.g., gastrointestinal). We fit conditional logistic regression models to estimate the odds ratio (OR) for the associations of medical conditions and subsequent ASD diagnosis. Adjusted models accounted for the matching by site and age and adjusting for sex, maternal race, maternal education, and household income. We also used the Conditional Inference Tree supervised clustering method to identify condition clusters associated with subsequent ASD risk.
Results: The average age of ASD diagnosis was 3.99 years. Of the 79 medical conditions tested, 38 were statistically significantly associated with subsequent diagnosis of ASD after adjusting for multiple testing. Developmental delay, mental health, and neurology conditions had the strongest associations with ASD diagnosis (ORs from 2.0 to 23.3). Within the developmental delay domain, language delays were the most frequently diagnosed among ASD cases during the pre-diagnostic period (49%) and most strongly associated with ASD risk (OR=23.3, 95% CI 21.4-25.4). Disruptive impulse conduct disorders (5.2%), attention-deficit/hyperactivity disorders (ADHD) (6.4%), and anxiety disorders (3.2%) were the most prevalent mental health conditions and had the strongest associations with ASD risk (ORs from 10-15). Moderately strong associations were observed for nutrition, genetic, ear nose and throat, and sleep disorder conditions (ORs from 2.1 to 3.2). Metabolic, musculoskeletal, ophthalmology, pulmonary, and many gastrointestinal conditions had weaker associations (ORs from 1.2 to 2.2). We identified several condition clusters associated with subsequent ASD diagnosis. Children with language delays in combination with mental health conditions had the highest risk of a subsequent ASD diagnosis. In the absence of developmental delay and mental health diagnoses, children with ophthalmology, ear nose and throat, and nutrition diagnoses were most likely to be subsequently diagnosed with ASD.
Conclusions: Children with ASD experience a higher prevalence of many medical conditions prior to their first ASD diagnosis. Using medical conditions as a predictive tool may speed the identification of children with ASD, leading to earlier intervention and improved outcomes.

1:57 **112.002** Pilot Randomized Control Trial of Cognitive Behavioral Therapy for Insomnia Modified for Families with a Child with Autism Spectrum Disorder

M. C. Souders[1], *J. E. Connell*[2], *R. Schaaf*[3], *C. M. Kerns*[4], *W. T. Eriksen*[5], *S. Zavodny*[6], *R. Sinko*[7], *L. Guy*[8], *B. A. Malow*[9] *and J. Pinto-Martin*[6], *(1)University of Pennsylvania/The Children's Hospital of Philadelphia, Philadelphia, PA, (2)Drexel University, Philadelphia, PA, (3)Thomas Jefferson University, Phhiladelphia, PA, (4)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (5)University of Pennsylvania School of Nursing, Philadelphia, PA, (6)University of Pennsylvania, Philadelphia, PA, (7)Thomas Jefferson University, Philadelphia, PA, (8)TEACCH Autism Program, University of North Carolina at Chapel Hill, Chapel Hill, NC, (9)Vanderbilt University Medical Center, Nashville, TN*

Background: Chronic severe insomnia is one of the most common conditions in children with Autism Spectrum Disorder (ASD), affecting 60-80%. Insomnia in ASD have many possible biological, behavioral and cultural mechanisms. Scientists hypothesize that anomalies in the synaptic pathways of the brain may account for “arousal dysregulation” in ASD. Arousal dysregulation may produce a constellation of behavioral symptoms including anxiety, sensory sensitivities, hyperactivity and insomnia. Based on the idea that a subgroup of children with ASD are in a hyper-aroused state, we developed a calming module that included 12 relaxing and soothing activities that could decrease arousal levels. We modified Cognitive Behavioral Therapy for Insomnia (CBT-I) and included the calming module to address the internal factors and sensory sensitivities that threaten sleep. Currently, the standard care (SC) for behavioral insomnia in ASD is a 1-hour parent education session using a Sleep Tool Kit developed by the ATN and this may not be sufficient in all children with ASD to improve their sleep.
Objectives:
Therefore, the specific aims of this pilot Randomized Control Trial (RCT) were to:

1. determine feasibility and acceptability of implementing a CBT-I and SC vs. SC only RCT.
2. estimate the effects of CBT-I and SC vs SC only on sleep parameters and arousal/anxiety symptoms.

Methods: Sample: 40 parent-child dyads, children ages 6-10 years with insomnia, Two-groups: n=20 SC only (control) vs n=20 CBT-I and SC. SC group received a 1hour education session.. The intervention group received SC plus CBT-I, which included 8 weekly home visits to teach and tailor positive evening routines, calming module, and faded bedtime protocol. Data was collected for both groups using actigraphy, sleep diary, CSHQ, PARS, SCARED, RBS and sensory profile at baseline, week 4 and week 8.
Results: 97 % of families reported that the randomization process and interventions were very acceptable. All children were able to tolerate the actigraph. Baseline mean sleep latency using actigraphy in both groups was over 30 minutes, meeting criteria for insomnia (36.73 min vs. 40.11 min). Both groups’ mean CSHQ score was above 42, indicating sleep problems. After intervention, CBT-I group had greater decrease in wake minutes (-65.68 min vs. -18.69 min, p=0.037), increase in sleep minutes (46.13 min vs. 8.24 min, p=0.073) and increase in percent sleep (10.61% vs. 2.26%, p=0.034) as compared to SC only. Sleep latency decreased for both groups (SC and CBT-I, -17.01 min, p=0.001; SC, -7.53min, p=0.083), but CBT-I group experienced a clinically significant decrease, with the average post-intervention sleep latency falling below the cut-off for insomnia (19.71 min).CBT-I parents reported a greater decrease in night wakings on the CSHQÂ than SC parents (-1.32 vs. -0.19, p=0.046).
Conclusions: Â This pilot RCT was acceptable and feasible. The SC intervention was effective at decreasing sleep latency and is consistent with previously published data. CBT-I group had more consolidated sleep, shorter sleep latency and fewer wake minutes than SC only group. CBT-I was effective in significantly improving night wakings which has been a difficult problem to solve for families with ASD.

2:09 **112.003** Trajectories of Reported Challenging Behaviours Derived from the Aberrant Behavior Checklist in a Cohort of Canadian Children with Autism Spectrum Disorders

T. Bennett[1], *P. Szatmari*[2], *E. Duku*[3], *S. Georgiades*[3], *I. M. Smith*[4], *P. Mirenda*[5], *J. Volden*[6], *L. Zwaigenbaum*[7], *M. Elsabbagh*[8], *W. Ungar*[9] *and T. Vaillancourt*[10], *(1)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (2)Centre for Addiction and Mental Health, Toronto, ON, CANADA, (3)McMaster University, Hamilton, ON, CANADA, (4)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (5)University of British Columbia, Vancouver, BC, CANADA, (6)University of Alberta, University of Alberta, AB, CANADA, (7)University of Alberta, Edmonton, AB, CANADA, (8)McGill University, Montreal, CANADA, (9)Sick Kids Research Institute, Toronto, ON, Canada, (10)University of Ottawa, Ottawa, ON, CANADA*

Background: Â Many children with Autism Spectrum Disorder (ASD) exhibit challenging behaviour that can interfere with child development and family well-being. Hyperactivity and irritability are common components of challenging behaviour. It is important to understand their developmental trajectories from time of diagnosis in order to effectively plan early intervention.
Â The Aberrant Behavior Checklist (ABC) was developed to measure the effects of intervention on challenging behaviour for people with intellectual disabilities (Aman, Singh, Stewart, & Field, 1985). The ABC is a 58-item caregiver-rated instrument with five subscales: Irritability, Lethargy, Stereotypy, Hyperactivity and Inappropriate speech, with higher scores indicating more severe problems. It has been used in several intervention studies among children with ASD (Kaat, Lecavalier & Aman, 2014).
Objectives: Â Using data from the longitudinal "Pathways in ASD" Study, we aim to examine: (a) the reliability and validity of the ABC in newly diagnosed children, (b) the stability of Hyperactivity and Irritability scores from (i) time of diagnosis at age 2-4 years to age 6 years, and (ii) after the transition to school (from age 6 years to age 12 years), (c) associations with parent- and teacher-reported aggression in participants at age 12.
Methods: Â Reliability of the ABC subscales was assessed using Cronbach's coefficient alpha and validity was assessed using correlations of subscales with the Child Behavior Checklist (CBCL) 1.5-5 and 6-18, Autism Diagnostic Observation Schedule (ADOS) and Vineland Adaptive Behavior Scales-II (VABS-II). Piecewise growth modeling was used to capture the trajectories during the preschool years and the transition at age 6 to and through the school context.Â Multiple regression was used to examine associations between Irritability and Hyperactivity scores at time of diagnosis with parent- and teacher-rated aggression as rated using the CBCL (controlling for baseline ASD symptoms and gender).
Results: Â Baseline data were obtained on 369 children, 84% boys, with mean age 40.8 months (SD 9.1 months).Â Internal consistencies for the subscales of the ABC varied between Cronbach's alpha of 0.8 and 0.9. Correlations between the ABC and CBCL subscales were 0.7 or greater, and correlations with the ADOS overall severity metric were low. Wave-to-wave correlations of the ABC Hyperactivity and Irritability subscales were 0.7 or greater. Correlations between the ABC Hyperactivity and Irritability subscales at each wave were 0.5 or greater. Examination of the Hyperactivity subscale trajectory showed relative stability in reported behaviours from time of diagnosis to age 6 years, after which reported Hyperactivity decreased over the school-aged period. However, for the trajectory of the Irritability subscale, a slight but constant decrease was seen from diagnosis to age 12. Parent-reported child Irritability and Hyperactivity scores at time of diagnosis were significantly associated with parent- and teacher-rated aggression problems at age 12.
Conclusions: The ABC shows adequate reliability and validity in this sample of children with ASD. Different trajectories were observed for Irritability and Hyperactivity subscales. Early childhood irritability and hyperactivity may predict higher levels of aggression at home and school during later childhood. Early intervention planning should explicitly assess child hyperactivity and irritability as important and potentially modifiable targets.

2:21 **112.004** Are Social and Communication Difficulties a Risk Factor for the Development of Social Anxiety?

H. Pickard[1], *F. Rijsdijk*[2], *F. Happé*[3] *and W. Mandy*[4], *(1)Social, Genetic and Developmental Psychiatry, King's College London, London, United Kingdom, (2)Institute of Psychiatry, KCL, London, UNITED KINGDOM, (3)King's College London, London, UNITED KINGDOM, (4)University College London, London, United Kingdom*

Background: Social Anxiety (SA) disorder is elevated in Autism Spectrum Disorder (ASD), a neurodevelopmental condition characterised by social and communication (SC) difficulties. In typically developing children, greater SC difficulties are commonly associated with heightened SA symptoms, both at a clinical and subclinical level. Whether SC difficulties place children at an increased risk of developing SA is unclear.
Objectives: Using a longitudinal design, this study aimed to disentangle the relationship between SC difficulties associated with ASD and SA symptoms in a population-based sample of children from the Avon Longitudinal Study of Parents and Children (ALSPAC).
Methods: Parent-reported data (n=9,491) on SC difficulties and SA symptoms was collected at age 7, 10 and 13. A cross-lagged panel design explored the stability and predictive relationship between latent SC difficulties and SA constructs over time. The specificity of these relationships was examined whilst controlling for generalised anxiety at all ages. Model comparisons were conducted to explore sex differences in these relationships.
Results: A significant relationship was observed between SA symptoms and SC difficulties at all ages. Earlier SC difficulties (age 7/10) predicted a significant amount of variance in later SA symptoms (age 10/13), but the reverse relationship from SA to SC difficulties was not observed. The relationship from SC difficulties to SA was strongest from 7 to 10 years old. The specificity analyses controlling for generalised anxiety revealed an identical pattern of results, with SC difficulties predicting SA, but not the reverse relationship. No sex differences in the directional relationships between SC difficulties and SA were observed.
Conclusions: The results indicate a directional and asymmetrical relationship with SC difficulties associated with ASD in mid-childhood predicting SA symptoms in late childhood. This suggests that SC difficulties may be an important and specific risk factor for the development of SA. A stronger contribution of SC difficulties to SA symptoms was observed in earlier childhood, suggesting that this may be a critical developmental period to target with earlier interventions. These findings indicate the importance of incorporating social skills training alongside effective interventions to alleviate symptoms of SA in children, as well as developing preventative approaches to foster SC development in those at a greater risk of developing clinical SA.

Oral Session - 1B
113 - New Directions in the Pharmacological Treatment of Social Disability in ASD
2:40 PM - 3:30 PM - Yerba Buena 3-6

Session Moderator: Bryan King, *UCSF Department of Psychiatry, University of California, San Francisco, San Francisco, CA*

2:40 **113.001** A Randomized Controlled Trial of Riluzole in Autism Spectrum Disorder

R. Nicolson[1], *T. Bennett*[2], *O. Akintan*[3], *C. Harvey*[4], *J. A. Brian*[5], *L. Capano*[6], *C. Hodgins*[7], *O. Kraus de Camargo*[3], *D. Mankad*[5], *A. Ahmad*[7], *M. Chalupka*[8], *L. Colli*[9], *L. Genore*[5], *A. Greco*[8], *T. Lui*[10], *A. Iaboni*[5], *I. O'Connor*[11], *D. Odrobina*[5], *K. Thorpe*[12] *and E. Anagnostou*[12], *(1)University of Western Ontario, London, ON, CANADA, (2)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (3)McMaster University, Hamilton, ON, Canada, (4)University of Western Ontario, London, ON, Canada, (5)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (6)Autism Research Centre, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (7)Lawson Health Research Institute, London, ON, Canada, (8)McMaster University, Hamilton, ON, CANADA, (9)Psychiatry and Behavioural Neuroscience, McMaster University, Hamilton, ON, CANADA, (10)Holland Bloorview, Toronto, ON, CANADA, (11)McMaster Universtiy-Offord Centre, Dundas, ON, CANADA, (12)University of Toronto, Toronto, ON, Canada*

Background: Medications currently indicated for children and adolescents with Autism Spectrum Disorder (ASD) are used to treat interfering behaviours often seen in ASD, but there are no medications with evidence supporting their use to treat the core symptoms of the disorder. Convergent evidence, however, suggests that ASD is associated with a shift in balance of neural excitation to inhibition. Riluzole is a glutamatergic modulator with neuroprotective and plasticity-enhancing properties, suggesting that it may play an important role in the treatment of neurodevelopmental disorders.
Objectives: The primary aim of this study was to investigate the safety and efficacy of riluzole in treating the core symptom domains in ASD. The effect of riluzole on interfering behaviours seen in children and adolescents with ASD was also examined.
Methods: 58 children and adolescents (mean age: 11.5±3.0 years) participated in a 12 week, randomized, double-blind, placebo-controlled trial of riluzole. Riluzole was started at 50mg daily and, for subjects 12 years of age and older, was increased after two weeks to 50mg twice daily. The primary outcome measure was the Aberrant Behaviour Scale – Social Withdrawal subscale [ABC-SW] score). Repetitive and ritualistic behaviors were evaluated by the Yale-Brown Obsessive-Compulsive Scale [YBOCS] total score, and the Repetitive Behaviour Scale [RBS] total score. Adverse effects were also assessed every two weeks using the Safety Monitoring Uniform Research Form (SMURF). Irritability, hyperactivity, and anxiety, common interfering behaviours in ASD, were evaluated using the relevant ABC subscales and the Spence Children's Anxiety Scale.
Results: 54 patients completed the trial. Four patients withdrew from the trial (two from each group), two due to adverse events and two due to the withdrawal of consent. Riluzole was well tolerated, with no serious adverse reactions reported.Â There were no significant differences between participants on placebo and those on riluzole with regards to social withdrawal, repetitive behaviour, or ritualistic behaviour (ABC-SW: p=0.3; YBOCS: p=0.1; RBS: p=0.1). However, subjects taking riluzole did have a significantly greater and clinically meaningful reduction in their scores on the ABC-Irritability (p=0.03) and ABC-Hyperactivity (p=0.03) subscales. None of the other outcome variables showed significant group differences.
Conclusions: Although riluzole was generally well-tolerated, it was not superior to placebo in terms of reduction in the core symptom domains of ASD. However, patients taking riluzole did show a significantly greater reduction in hyperactivity and irritability, both of which are interfering symptoms commonly associated with ASD.

2:52 **113.002** A Randomized Controlled Trial of Intranasal Oxytocin in Autism Spectrum Disorder

E. Anagnostou[1,2], *J. A. Brian*[1,2], *C. Campo-Soria*[3], *L. Capano*[1,4], *A. N. Esler*[3], *R. Hudock*[3], *D. Mankad*[1,2], *M. Penner*[1,2], *S. Francis*[3], *L. Genore*[2], *A. Iaboni*[2], *D. Odrobina*[2], *N. Peleg*[2], *D. Rambeck*[3], *E. L. Shankland*[3], *A. Dupuis*[1,5] *and S. Jacob*[3], *(1)University of Toronto, Toronto, ON, Canada, (2)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (3)University of Minnesota, Minneapolis, MN, (4)Autism Research Centre, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (5)The Hospital for Sick Children, Toronto, ON, Canada*

Background: There are currently no medications with evidence supporting their use to treat the core symptoms of the disorder. Convergent evidence, however, suggests a role for oxytocin in social cognition and reward.
Objectives: The primary aim of this study was to investigate the safety and efficacy of intranasal oxytocin in treating social withdrawal in autism spectrum disorder (ASD). The effect of oxytocin on social cognition as well as anxiety was also examined.
Methods: 60 children and adolescents (mean age: 12.4 ± 1.8 years) participated in a 12 week, randomized, double-blind, placebo-controlled trial of oxytocin, at 0.4 IU/kg twice a day. The primary outcome measure was the Aberrant Behavior Scale – Social Withdrawal subscale [ABC-SW] score). Adverse effects were also assessed every two weeks using the Safety Monitoring Uniform Research Form (SMURF). Aspects of social cognition as well as anxiety and quality of life were also evaluated.
Results: 54 patients completed the trial. 6 patients withdrew from the trial (5 active, 1 placebo), 1 due to adverse events and 5 due to the withdrawal of consent. Oxytocin was overall well tolerated, with no serious adverse drug reactions reported.Â There were no significant differences between participants on placebo and those on oxytocin on social withdrawal (ABC-SW: p=0.6). However, participants taking oxytocin did have a significant improvement in social recognition as measured by the Let's Face It! Battery (p=0.02). This was not seen in the case of object recognition as measured by the same battery (p=0.4) suggesting a specific social recognition effect.
Conclusions: In our sample, oxytocin was not superior to placebo in terms of reduction in social withdrawal. However, participants taking oxytocin did show a significant improvement in social recognition, suggesting that oxytocin may impact aspects of social cognition but may not be adequate to improve social function on its own.Â Implications for combination trials will be discussed.

3:04 **113.003** Intranasal Vasopressin Treatment Improves Social Abilities in Children with Autism

K. J. Parker[1], *O. Oztan*[1], *R. A. Libove*[1], *R. D. Sumiyoshi*[1], *D. S. Karhson*[1], *J. Summers*[2], *K. Hinman*[1], *K. S. Motonaga*[3], *L. K. Fung*[1], *D. S. Carson*[1], *J. M. Phillips*[1], *J. P. Garner*[4] *and A. Y. Hardan*[1], *(1)Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA, (2)Georgetown University, Washington, DC, (3)Pediatrics, Stanford University, Palo Alto, CA, (4)Comparative Medicine, Stanford University, Stanford, CA*

Background: There are currently no medications that target autism spectrum disorder (ASD)'s core social deficits. However, neurobiological systems that are critical for social functioning are arguably one of the most promising for ASD therapeutic target discovery. Arginine vasopressin (AVP) is one such candidate; it plays a critical role in promoting social behavior and experimental dysregulation of the AVP signaling pathway produces social deficits in animal models.
Objectives: We tested the safety and efficacy of 4-week intranasal AVP administration to improve social abilities in children with ASD using a double-blind randomized placebo-controlled trial design.
Methods: Participants were medically healthy outpatients (N=18 males, N=4 females), aged 6 to 12 years. Participants underwent comprehensive diagnostic and behavioral testing, and blood samples for safety monitoring and biomarker quantification were obtained. Participants were then randomized 1:1 to receive either AVP treatment (a maximum of 12 IU BID or 16 IU BID based on age) or placebo treatment. The primary outcome measure was change in social ability as assessed by parent ratings on the Social Responsiveness Scale 2 (SRS-2) between baseline and after treatment. Throughout the trial, drug safety was assessed. Upon completion of treatment, SRS-2 ratings and participants' blood samples were again obtained. Blood AVP levels and oxytocin receptor (OXTR) and AVP receptor v1a (AVPRv1a) gene expression levels were quantified via enzyme immunoassay and qPCR, respectively.
Results: Using a general linear model, including treatment (drug vs. placebo) and the biomarker measures, we found that treatment efficacy depended on pre-treatment AVP levels ($F_{1,9}=7.3544$; $P=0.0239$). Further analysis revealed that pre-treatment AVP levels predicted treatment response in participants receiving drug ($P=0.0099$), but not in those receiving placebo, suggesting that pre-treatment AVP levels may be useful in discerning children most likely to respond to AVP treatment. The treatment x AVP levels interaction therefore informed our comparison of drug-treated and placebo-treated participants. AVP-treated participants improved by an average of 12.8 ± 3.5 points on the SRS-2 Total Score ($P=0.0102$), but placebo-treated participants' SRS-2 Total Scores did not significantly differ from a 0 point improvement. We also observed a pre-treatment "biomarker signature" that predicted treatment efficacy. Thus, in addition to the effect of pre-treatment AVP levels, participants with lower OXTR gene expression, and higher AVPRv1a gene expression, showed greater improvement in SRS-2 Total Scores, particularly when relative expression was contrasted in each participant ($F_{1,9}=8.060$; $P=0.0194$). Finally, no differences in the rates of adverse events were observed between the placebo-treated and AVP-treated groups, and there were no changes from baseline in patients' electrocardiogram, vital signs, or clinical laboratory measurements during AVP treatment.
Conclusions: This is the first study to show that intranasal AVP treatment is well tolerated and improves social abilities in individuals with ASD. Findings from this pilot study also suggest that pre-treatment neuropeptide measures may help identify patients most likely to benefit from AVP treatment. This research has high potential to lead to development of the first effective and personalized medication to treat ASD's currently intractable social deficits.

3:16 **113.004** Results of a Phase 2 Randomized Double-Blind Placebo Controlled Study (VANILLA) Investigating the Efficacy and Safety of a V1a Antagonist (RG7314) in Adult Men with ASD

F. Bolognani[1], *M. del Valle Rubido*[2], *L. Squassante*[3], *C. Wandel*[3], *X. Liogier D'ardhuy*[4], *L. Boak*[5], *M. Derks*[6], *H. Kletzl*[3], *S. L. Lennon-Chrimes*[7], *L. Murtagh*[2], *J. Noldeke*[8], *P. Fontoura*[9], *O. Khwaja*[2] *and D. Umbricht*[2], *(1)Neuroscience, Ophthalmology, and Rare Diseases (NORD) Roche Pharma Research and Early Development Roche Innovation Center Basel, F. Hoffmann - La Roche AG, Basel, Switzerland, (2)F. Hoffmann - La Roche AG, Basel, SWITZERLAND, (3)F. Hoffmann-La Roche Ltd, Basel, Switzerland, (4)Neuroscience, Ophthalmology and Rare Diseases, F. Hoffmann-La Roche Ltd, Basel, Switzerland, (5)F. Hoffmann-La Roche AG, Basel, SWITZERLAND, (6)F. Hoffmann-La Roche Ltd, Welwyn, United Kingdom, (7)Roche Products, Welwyn Garden city, UNITED KINGDOM, (8)Teva Pharmaceuticals, Basel, SWITZERLAND, (9)F.Hoffmann-La Roche, Basel, SWITZERLAND*

Background: The neuropeptide vasopressin (AVP) acts both as an endocrine hormone in the periphery and locally in the brain where it modulates social behaviors. Several lines of evidence suggest that inhibition of the vasopressin 1a receptor (V1a) could be beneficial for the treatment of core symptoms of Autism Spectrum Disorder (ASD). In the valproic acid rat model of ASD, V1a inhibition has been shown to improve social deficits in a dose-dependent manner. In a recently conducted proof-of-mechanism study we have shown that a single i.v. dose of a V1a inhibitor (RG7713) leads to subtle improvements of biomarkers of social communication in male adults with high-functioning ASD. RG7314 is an orally available V1a competitive antagonist with high specificity for V1a over V1b, V2, and oxytocin receptors that has demonstrated a favourable safety profile and pharmacokinetic parameters in healthy volunteers.
Objectives: The primary objectives of the VANIILA study were to evaluate: 1) the efficacy of 12-week treatment with RG7314 in treating social and communication deficits in adult men with high functioning ASD and 2) the safety and tolerability of RG7314. Secondary and exploratory objectives included the evaluation of effects of RG7314 on aberrant, adaptive, and repetitive behaviours, anxiety and mood as well as the estimation of pharmacokinetics parameters.
Methods: A staggered parallel-group, randomized, double-blind, placebo-controlled study was conducted with three doses of RG7314 (1.5, 4 or 10 mg PO per day). The treatment duration was 12 weeks and the study proceeded sequentially through four stages. Transitions from one stage to the next were decided by an Internal Monitoring Committee and an external Scientific Oversight Committee and the decisions were based on safety data review. Stage 1 tested placebo and 1.5 mg; Stage 2 placebo and 4 mg; Stage 3 placebo and 10 mg; and Stage 4 placebo, 1.5 mg, and 10 mg. The primary outcome measure was the caregiver rated SRS-2 scale. Secondary and exploratory measurements included the Vineland Adaptive Behavior Scales, second edition (VABS-II), the Aberrant Behavior Checklist (ABC), the Repetitive Behavior Scale-Revised (RBS-R), CGI-I, the State-Trait Anxiety Inventory (STAI), and the Anxiety, Depression and Mood Scale (ADAMS), amongst others. ClinicalTrials.gov Identifier: NCT01793441.
Results: A total of 223 subjects were enrolled in the four Stages (Stage 1 = 17; Stage 2 = 111; Stage 3 = 24; and Stage 4 = 71 and the dropout rate was 16.6%. At baseline, mean age was 25 years (SD = 6.53), mean FSIQ was 98.03 (SD=16.52), mean SRS-2 t-score was 77.52 (SD=7.26), mean CGI-S was 4.39 (SD=0.55), and mean Vineland-II™ Standard Composite Score was 60.8 (SD=13). Age, IQ, and ASD severity measures at baseline were generally well-balanced across treatment groups. Based on a blinded preliminary interim assessment, RG7314 appears to be safe and well tolerated. The final primary, secondary, and exploratory outcome measures results will be presented at the meeting.
Conclusions: The VANILLA study provides valuable data to understand the safety, pharmacokinetics, and the effects of RG7314 on social, communication and repetitive behaviours.

Oral Session - 2A
114 - Brain Structure in ASD Across the Lifespan
1:45 PM - 2:35 PM - Yerba Buena 7

Session Moderator: Declan Murphy, *Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

1:45 **114.001** Altered Structural Connectivity of Language Tracts in 6-Week-Old Infants at High Risk for ASD

J. Liu[1], *T. Tsang*[1], *L. P. Jackson*[2], *C. Ponting*[3], *S. S. Jeste*[4], *S. Y. Bookheimer*[1] *and M. Dapretto*[1], *(1)University of California, Los Angeles, Los Angeles, CA, (2)Semel Institute, UCLA, Los Angeles, CA, (3)Clinical Psychology, UCLA, Los Angeles, CA, (4)UCLA, Los Angeles, CA*

Background: Altered structural connectivity has been identified as a possible biomarker of autism spectrum disorder (ASD) risk in the developing brain. Several studies using diffusion tensor imaging (DTI) have shown reduced integrity of major white matter tracts in infants and toddlers who later developed ASD (Conti et al., 2015). Moreover, infants eventually diagnosed with ASD showed slower development of white matter tracts from 6 to 24 months (as indexed by fractional anisotropy (FA) values; Wolff et al. 2012), suggesting that altered or delayed structural connectivity in the early infant brain may be a useful biomarker of ASD. Examining white matter tracts specifically associated with social communicative functions (i.e., language) may lend further insight into early signs of ASD risk. For instance, the arcuate fasciculus (AF), connecting posterior temporal to premotor cortex, and the superior longitudinal fasciculus (SLF), connecting posterior temporal cortex to the inferior frontal gyrus, are two dorsal fiber tracts that connect key language regions of the brain. The AF is myelinated before the SLF, suggesting that the integration of sensory and motor representations must precede more advanced aspects of language processing (Perani et al., 2011). As such, structural connectivity in these tracts could also be used as a predictor of language outcome and ASD diagnosis.
Objectives: Here we investigated key white matter pathways of the dorsal language network in 6-week-old infants at high (HR) and low risk (LR) for ASD to identify atypicalities in structural connectivity that may predict altered developmental trajectories prior to overt language delays and the onset of ASD symptomatology.
Methods: DTI data were collected while infants underwent MRI during natural sleep. Preprocessing was conducted in FSL. Probabilistic tractography was used to examine the AF and SLF in both hemispheres. Indices of white matter integrity (including average fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD), and radial diffusivity (RD)) were extracted from probabilistic tractography and subsequently related to behavioral indices of language development and ASD symptomatology.
Results: Average FA in the AF was significantly higher in the LR group compared to the HR group, but only in the left hemisphere. In contrast, no significant between-group differences were observed for the SLF. Interestingly, however, indices of white matter integrity significantly correlated with later behavioral outcome as indexed by the Autism Observation Scale for Infants (AOSI) at 12 months of age.
Conclusions: These data suggest that early patterns of structural connectivity in the developing brain are measurably different in infants at high risk for developing ASD as early as 6 weeks of age. In line with prior evidence indicating that the SLF matures at a slower rate than the AF, significant differences were observed in the AF but not in the SLF. Specifically, LR infants show higher FA in the left AF, indicating a more mature pattern relative to HR infants. Furthermore, measures of white matter integrity relate to ASD symptomatology. These findings indicate that early differences in language-relevant white matter pathways may predict future language development and provide an early biomarker of ASD risk.

1:57 **114.002** Girls and Boys with Autism Spectrum Disorder Relative to Same-Sex Typically Developing Peers Exhibit Distinct Cortical Folding Abnormalities during Late Childhood and Adolescence

D. Yang[1,2], *S. M. Abdullahi*[3], *A. Jack*[1], *P. E. Ventola*[3], *E. H. Aylward*[4], *M. Dapretto*[5], *D. H. Geschwind*[5], *J. Duncan*[6,7], *S. J. Webb*[8], *S. Y. Bookheimer*[5], *L. Kenworthy*[2], *J. D. Van Horn*[9] *and K. A. Pelphrey*[1,2], *(1)Autism and Neurodevelopmental Disorders Institute, The George Washington University, Washington, DC, (2)Children's National Health System, Washington, DC, (3)Yale Child Study Center, New Haven, CT, (4)Seattle Children's Research Institute, Seattle, WA, (5)University of California, Los Angeles, Los Angeles, CA, (6)Department of Radiology & Biomedical Imaging, Yale University School of Medicine, New Haven, CT, (7)Department of Biomedical Engineering, Yale University, New Haven, CT, (8)University of Washington, Seattle, WA, (9)Laboratory of NeuroImaging, University of Southern California, Los Angeles, CA*

Background: Anatomical imaging studies have revealed pronounced and widespread reductions in gyrification during adolescence in healthy subjects, reflecting a late period of brain maturation. It is not known whether males and females with Autism Spectrum Disorder (ASD) relative to same-sex peers without ASD exhibit cortical folding abnormalities during this developmental period, and how much theÂ abnormalities may overlap.
Objectives: To examine and compare cortical folding abnormalities as measured by an index of local gyrification in girls and boys with ASD during late childhood and adolescence.
Methods: The sample included 219 children and teens (age: M = 13.01y, SD = 2.91y, range = 8.03 – 17.99y; IQ: M = 107.50, SD = 17.87, range = 75 - 167) recruited from five research sites (Yale, Harvard, UCLA, Seattle-1, Seattle-2). There were 54 ASD females, 52 TD females, 59 ASD males and 54 TD males. The four groups were well-matched on age and IQ. Females and males with ASD were well-matched on ASD symptom severity, language ability and adaptive behaviors. F-ASD and F-TD were well-matched on intracranial volume, so were M-ASD and M-TD. All participants underwent a T1-weighted structural scan. Cortical folding was estimated using FreeSurfer v5.3.0 with an additional flag of local gyrification index. Quality of the sMRI images were independently blind-rated by two authors (DY and SA); 30 subjects (6 F-ASD, 5 F-TD, 17 M-ASD, 2 M-TD) exhibiting obvious head motion were discarded. Age was centered before entered into analysis. Results were thresholded at $Z>1.96$ (vertex-level) and $p<.05$ (cluster-level) (two-sided).
Results: While across all participants, there were widespread age-related reductions in cortical folding, ASD males relative to TD males exhibited lower mean levels of cortical folding in the right insula and right postcentral gyrus, combined with abnormally accelerated age-related reductions in cortical folding in the right pars triangularis and the left lateral orbital frontal gyrus. In contrast, ASD females relative to TD females exhibited lower mean levels of cortical folding in the left superior parietal gyrus, and abnormally accelerated age-related reductions in cortical folding in the left rostral middle frontal gyrus.
Conclusions: Our results reveal that females and males with autism relative to their same-sex healthy control counterparts exhibit cortical folding abnormalities during late childhood and adolescence, suggesting abnormally accelerated brain maturation during this period in autism. The specific brain regions exhibiting abnormalities vary by sex, revealing different neurodevelopmental signatures of autism in girls vs. boys.

2:09 **114.003** Longitudinal Pre- and Postnatal Brain Growth Trajectory in ASD: Evidence for a Late Gestation Critical Time Window

F. Bonnet-Brilhault[1], *T. Rajerison*[2], *A. Saby*[3], *M. Guimard-Brunault*[3], *E. Houy-Durand*[1], *S. Roux*[4] *and J. Malvy*[1], *(1)UMR930, INSERM, Université François –Rabelais de Tours, Tours, France, (2)Child Psychiatry, CRA Aquitaine, Bordeaux, France, (3)CRA Centre Val de Loire, CHRU de Tours, Tours, France, (4)Université François Rabelais de Tours, INSERM U930, Tours, France*

Background:
Longitudinal pre- and post-natal brain growth trajectory in ASD remains unexplored despite severalÂ pathophysiological findings targeting both gestational period and early post-natal life. Furthermore early brain overgrowth has been largely reported but more recent studies on large populations do not replicate this result, highlighting both physiopathological and clinical heterogeneity in ASD.
Objectives:
The aim of this study was to characterize longitudinal brain growth trajectory in ASD in both prenatal and postnatal periods to identify the critical time window forÂ pathological neurodevelopmentalÂ processes.
Methods:
Prenatal and postnatal biometric parameters were collected in fetal Ultrasound records and medical records of 94Â patients with ASD (87 males/7 females; meanâ€‰age ±â€‰standard deviation 7.5 ±3.5 years) recruited and fully examined at the Center of Excellence in Autism in Tours (France).Â Diagnosis was made according to DSM-IV-R and DSM-5 criteria (American Psychiatric Association, 2000, 2013) and by using the Autism Diagnostic Interview or the Autism Diagnostic Observation Schedule-Generic. Diagnosis was complemented by the Childhood Autism Rating Scale, Behavioral Summarized Evaluation scale and Developmental Quotients using standardized tools. In utero parameters at 2nd and 3rdtrimester of gestation included Biparietal Diameter (BPD), Femur Length (FL) (N = 94: 87M / 7F) and Head Circumference (HC) (N = 70: 66M / 4F). Postnatal parameters included, HC, body length and birth weight (N = 70: 66M / 4F), HC at 1 year and 2 years (N = 54: 52M / 2F).
Results:
Compared to a French nationally recognized, normative database, ASD patients exhibited greater increase in HC between the 2nd (t= 2.58; p=0.01) and 3rd(t=3.37; p=0.001) trimesters of gestation, whereas BPD and femur length were not significantly increased. At birth, normal HC and weight were observed whereas body length was significantly larger (t=5.01; p<0.001). No brain overgrowth was observed during the first two years of life.
Conclusions:
This first longitudinal pre- and postnatal brain growth study in ASD suggests atypical neurodevelopmental processes during a critical time window between the 2nd and 3rd trimesters of gestation. This result opens discussions on pathophysiological tracks including genetic, inflammatory and structural pathways during this period. Accelerated postnatal brain growth seemed to be inconsistent and illustrates the clinical heterogeneity of ASD.

2:21 **114.004** Amygdala Neuron Number in ASD Is Increased at Pediatric Ages but Decreased By Adulthood

T. A. Avino[1], *N. Barger*[1], *M. V. Vargas*[1], *M. Bauman*[1], *D. G. Amaral*[2] *and C. M. Schumann*[1], *(1)Psychiatry & Behavioral Sciences, University of California, Davis, MIND Institute, Sacramento, CA, (2)Department of Psychiatry & Behavioral Sciences, University of California-Davis, Sacramento, CA*

Background: The amygdala is a complex cluster of nuclei located in the rostral portion of the temporal lobe. It plays a prominent role in modulating socioemotional processing, yet little is known about the postnatal neuronal development of this structure in humans. Structural and functional imaging studies have demonstrated an altered age-related growth trajectory and activation of the amygdala across the lifespan in individuals with autism. However, the cellular substrates that underlie this aberrant growth and function are not well understood.
Objectives: Our goal was to quantify the number of mature neurons within subregions of the amygdala in both typical development and autism across the lifespan. We also examine the number of immature neurons within the basal complex of the amygdala using immunohistochemistry as a function of both age and diagnosis.
Methods: We performed a stereological analysis of neuron number and size in subregions of the amygdala utilizing postmortem tissue from 50 human brains (28 Autism, 22 Typical; ages: 2-48 years old) representing the largest study of its kind to date. Additionally, we performed immunohistochemistry for B-cell lymphoma 2 (bcl-2) to examine the number of immature neurons within the basal complex of the amygdala.
Results: The ANOVA analyses demonstrate a significant main effect of diagnosis for lateral nucleus mature neuron number ($F(1,39) = 5.24$, $p < .05$), and significant interactions between age and diagnosis for the total amygdala ($F(2,41) = 5.69$, $p < .01$), basal nucleus ($F(2,41) = 7.13$, $p < .01$), accessory basal nucleus ($F(2,41) = 6.85$, $p < .01$), and central nucleus ($F(2,39) = 4.23$, $p < .05$). *Post hoc* comparisons show that within the pediatric group, individuals with autism have more mature neurons than neurotypical individuals in the basal and central nuclei. In adult cases, individuals with autism have significantly fewer mature neurons relative to neurotypical adults in the total amygdala and in the lateral, basal, and accessory basal nuclei. Preliminary examination of immature neurons shows significant age-related reductions of bcl-2 immunoreactive neurons in the basal complex of the amygdala.
Conclusions: These findings provide the first evidence of the normal pattern of lifelong neuronal development and maturation in the postnatal human amygdala. Furthermore, we demonstrate that these typical processes are disrupted in autism, resulting in an age-related loss of neurons across amygdala nuclei in adults with autism. Our results implicate altered neuronal maturation of the amygdala at early ages in autism with potential subsequent degeneration of this structure in adulthood.

Oral Session - 2B
115 - Neuropathology, Imaging Genetics, and Imaging-behavior Correlations
2:40 PM - 3:30 PM - Yerba Buena 7

Session Moderator: Declan Murphy, *Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

2:40 **115.001** Sex-Specific Alterations in Motor Network Morphology in Relation to Repetitive Behaviours: A Twin Study

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Background:
Restricted and repetitive behaviors and interests (RRBI's) are core symptoms of autism spectrum disorder (ASD) (DSM-5) that are thought to be less prevalent in females than males (Van Wijngaarden-Cremers et al., 2014). Differences in the phenotypic expression and etiology of ASD, including structural morphology of the brain, might underlie this prevalence difference (Supekar and Menon, 2015, Lai et al., 2015). However, for results to be generalizable, the heterogenous expression of ASD, related to variability in environmental and epigenetic factors, needs to be controlled for.
Objectives:
The current study, within the Roots of Autism and ADHD Twin Study Sweden (RATSS) (Bölte et al., 2014), implemented a within-twin pair design to investigate sex differences in the relation between RRBI's and detailed structural morphology of neocortical motor networks.
Methods:
T1-weighted images from 29 female and 39 male MZ and DZ twin pairs (i.e. 134 participants including neurotypicals and individuals across the whole ASD spectrum), aged 9-24 years, were analysed using surface-based morphology software (Freesurfer) to obtain estimates of cortical volume, surface-area and thickness of gyri and sulci involved in the motor network: central, pre-and post-central, superior frontal (including the supplementary motor area), supramarginal, angular, intra-parietal and superior parietal areas. RRBI's were assessed using the subscale from the Autism Diagnostic Interview – Revised (Rutter et al. 2003). Within-pair differences in surface-based estimates were correlated to differences in RRBI's using generalized estimating equation linear models, while controlling for total brain volume and handedness (Edinburgh handedness inventory).
Results:
Behaviourally, males and females did not differ in within-twin pair differences in RRBI's (Kruskal-Wallis $\chi2(1) = 0.007$, $p = 0.9$). Neuroanatomically, RRBI scores were primarily associated with alterations in bilateral primary motor cortex, left SMA and intraparietal sulcus in females, but with alterations in left sensory cortex and the corresponding sensory associative parietal region in males. In females, the associations were mostly negative, indicating that an increase of RRBI symptoms was related to a decrease in brain morphological features. In males, the findings were differentially positively or negatively related to RRBIs. The details of the within-pair association between brain estimates and symptom is reported in table 1.
Conclusions:
Although females did not differ from males on RRBI symptoms, we report different and more regions of the neocortical motor network to be associated with RRBI's in females, supporting the female protective hypothesis. Females were particularly affected in primary motor and SMA in accordance with previous research showing that gray matter in these regions was related to RRBI's in girls, but not boys with autism (Supekar and Menon, 2015). Moreover, we show that RRBIs are associated with anatomical differences of the neocortical motor network even while controlling for genetic and shared environmental factors, indicating that these effects are partly due to non-shared environmental factors. Taken together, our findings suggest that the autistic phenotype is associated with different underlying neurobiology in females.

2:52 **115.002** Autism Risk Gene CNTNAP2 Was Associated with Cingulate Anatomy in Individuals with Autism Spectrum Disorder

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Background:
Contactin Associated Protein-Like 2 (CNTNAP2) has been implicated in neurodevelopmental disorders such as autism spectrum disorder (ASD). In addition to being associated with impaired development of language, CNTNAP2 may turn out to be a central node in the molecular networks controlling neurodevelopment. Evidence has shown that carriers of common variants of CNTNAP2 may have altered brain connectivity. Whether the genetic variants of CNTNAP2 are associated with cingulate structure that shows abnormal structure and function in ASD is not yet studied.
Objectives:
This study aims to investigate the association between CNTNAP2 variants and the anatomical structure of cingulate gyrus.
Methods:
We recruited 122 patients with ASD and 118 typically-developing controls. All the participants underwent brain MRI imaging. Brain volume, white matter volume, cortical thickness, and gyrification of cingulate gyrus were analyzed by FreeSurfer software with 74 automatic parcellation. Cingulate gyrus was divided into anterior, middle (anterior and posterior), and posterior cingulate (dorsal and ventral) when comparing volume, gyrification, and cortical thickness. For white matter volume comparison, cingulate gyrus was divided into rostral anterior, caudal anterior, and posterior cingulate. Five SNPs of CNTNAP2 that has been reported to be associated with ASD were genotyped. Main effect of each SNP and group*SNP interaction were examined for each region of cingulate gyrus.
Results:
Preliminary analysis showed that some candidate SNPs of CNTNAP2 may be associated with the gyrification and cortical thickness of anterior part of middle cingulate gyrus and ventral part of posterior cingulate gyrus, with significant age by SNP interaction as well as age by SNP by diagnosis interaction. There was no difference on the regional volume or white matter volume. After Bonferroni correction, the SNP main effect and age interaction remained significant on gyrification of anterior part of middle cingulate gyrus. When ASD and TD were separated, age interaction was still shown in ASD but not in TD, on the gyrification of both regions and on the cortical thickness of ventral part of posterior cingulate gyrus. However, the CNTNAP2 variants we selected were not associated with clinical severity of autistic symptoms in either ASD or TD group, measured by Social Responsiveness Scale and Social Communication Questionnaire.
Conclusions:
Our findings suggest that CNTNAP2 variants might be associated with the gyrification and cortical thickness of middle and posterior cingulate structure, particularly in ASD. These findings need validation in independent samples.

3:04 **115.003** GABA Receptor Binding Density in the Striatum of Individuals with Autism: Novel Findings for Consideration When Designing Human Clinical Autism Studies with Inhibitory Modulators

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Background:
The basal ganglia (BG) is a collection of sub-cortical nuclei that contain inhibitory GABAergic spiny projection neurons (SPN's). The BG projects to the thalamus and has reciprocal connections with multiple cortical regions and the cerebellum. The BG nuclei are implicated in OCD, habit formation, motor, speech, and language disorders. Thus, the BG is an ideal region of interest to examine the neurochemical basis of repetitive, stereotyped behavior and social communication difficulties observed in autism. Prior clinical trials using GABA receptor modulators as treatment in autism have yielded mixed results due to poor behavioral endpoint design. Therefore, the current investigation specifically examines the role of $GABA_A$ receptor changes compared to $GABA_B$ in select regions of the BG in postmortem cases from individuals with autism compared to typically developing controls. Previously, Wegiel et al. (2014) reported volumetric and neuronal density changes in specific BG regions in postmortem autism cases, and Oblak et al. (2011) found a decrease in $GABA_B$ receptor binding in the cingulate cortex, a source of diffuse limbic input to the dorsal striatum.
Objectives:
To determine the binding density of inhibitory $GABA_A$ receptors compared to $GABA_B$ in the BG, specifically, the dorsal and the ventral striatum in autism cases versus controls.
Methods:
Forty-one post-mortem cases were examined in select regions of the BG in age- and PMI-matched cases (n=20 control and n= 21 autism). Sampled regions in the dorsal striatum included caudate and putamen and sampled regions in the ventral striatum included the NAcc core and shell. Cryostat cut 20 µm sections from these regions were incubated with either [^{3}H]-Flunitrazepam 5 nM ($GABA_A$) or [^{3}H]-CGP 54626 3 nM ($GABA_B$) then loaded into X-ray cassettes with tritium standards and apposed to tritium-sensitive film for twelve weeks and fourteen weeks respectively. Two sections per case were used for determining total binding with the tritiated ligand and one section was used for non-specific binding with a competitive displacer. After exposure, the films were developed and digitized on a MCID platform to quantify measurements of binding in femtomoles per milligram of tissue for the ligand. Analysis was performed using student's t-test.
Results:
Significantly high $GABA_A$ expression revealed by [^{3}H]-Flunitrazepam binding was observed in dorsal striatum ($p=0.0024$) and ventral striatum ($p=0.0103$) in autism. In contrast, $GABA_B$ expression revealed by [^{3}H]-CGP 54626 binding was found to be unchanged in the dorsal striatum as well as the ventral striatum in subjects with autism compared to controls ($p>0.05$).
Conclusions:
Since $GABA_A$ receptors are present mainly post-synaptically, increased $GABA_A$ receptors with unchanged $GABA_B$ receptors implies postsynaptic alteration, which adds evidence to excitatory/inhibitory imbalance in select regions of the autism brain. Increased expression of $GABA_A$ receptors is a possible compensation to increased excitatory cortical inputs. Understanding the consequences of GABA receptor alterations in the BG is important for dissecting BG circuitry and its effects on cortical and BG related behaviors. Future human studies using inhibitory modulators should consider changes to GABA receptor targets in the striatum when designing experiments and planning end point outcome measures for clinical trials.

3:16 **115.004** Shared Differences Across Cortical Morphometry Features Associated with Autism Spectrum Disorder

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Background: Aspects of cortical structure such as cortical thickness, surface area, gyrification, and grey-white matter boundary integrity may represent different biological pathways underlying Autism Spectrum Disorder (ASD). Often these anatomical features are investigated in isolation. However, the identification of between-group differences that are shared across modalities could aid in identifying underlying neural mechanisms common to different anatomical features in ASD.
Objectives: We aimed to (1) identify multimodal components representing the inter-relationship between different *in vivo* MRI morphometric measures of cortical anatomy and to (2) relate these components to the ASD phenotype.
Methods: 98 adults with ASD (49 males and 49 females; diagnosed using the ADI-R and ADOS) and 98 matched typically developing controls (51 males and 47 females) aged 18-42 years received structural MRI scans at the Institute of Psychiatry, Psychology and Neuroscience, London, and the Autism Research Centre, Cambridge. Freesurfer software (http://surfer.nmr.mgh.harvard.edu/) was used to derive a set of eight morphometric features describing cortical surface anatomy for each participant (i.e. cortical volume, thickness, surface area, sulcal depth, mean radial curvature, metric distortion, local gyrification index, and grey to white matter signal intensity ratios). A multimodal fusion technique, linked independent components analysis (linked ICA) (Groves et al. 2011, 2012), was used to identify components comprised of shared inter-subject variation between the different cortical measures. Relationships between individual multi-modal components and ASD diagnosis and Autism Spectrum Quotient (AQ) scores were assessed through correlation analysis.
Results: We found one component representing increased cortical thickness and grey-white matter signal intensity ratio (GWR) in temporal and parietal regions as well as decreased gyrification in the cingulate gyrus, which was significantly negatively correlated with a diagnosis of ASD ($p=6.6^{e-5}$) and AQ scores ($p=4.2^{e-4}$). A second component representing (1) increased GWR across the entire cortex, (2) increased cortical thickness and surface area in frontal-temporal regions and (3) decreased cortical folding and gyrification in temporal regions also had a significant negative correlation with AQ measures ($p=3.3^{e-2}$).
Conclusions: We found significant correlations with ASD diagnoses and components comprising of reductions in grey-white matter boundary integrity and cortical thickness as well as increased gyrification. Our findings enrich understanding of the relationship between cortical features, and may aid in identifying neurobiological pathways that contribute to the cross-modal pattern of atypical cortical structure observed in ASD.

Oral Session - 3A

116 - Interventions with Young Children and Parents

1:45 PM - 2:35 PM - Yerba Buena 8

Session Moderator: Connie Kasari, *University of California, Los Angeles, Los Angeles, CA*

1:45 **116.001** Randomised Trial of a Prodromal Intervention for Infants at High Risk for Autism: Longitudinal Outcomes to Age Three Years

J. Green[1], *E. Jones*[2], *T. Gliga*[3], *M. W. Wan*[4], *A. Pickles*[5], *V. Slonims*[6], *G. Pasco*[7], *M. Elsabbagh*[8], *R. Bedford*[9], *T. Charman*[10] *and M. H. Johnson*[3], *(1)University of Manchester, Manchester, England, United Kingdom, (2)Birkbeck, University of London, London, UNITED KINGDOM, (3)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (4)University of Manchester, Manchester, UNITED KINGDOM, (5)King's College London, London, UNITED KINGDOM, (6)Evelina Children's Hospital Guy's and St Thomas' NHS Foundation Trust, London, UNITED KINGDOM, (7)Institute of Psychiatry, London, UNITED KINGDOM, (8)McGill University, Montreal, CANADA, (9)Kings College, London, UNITED KINGDOM, (10)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: Â There has been increasing interest in the potential for pre-emptive (pre-diagnostic) interventions in the infancy prodrome of autism, but little investigation as to their effect.
Objectives: To determine the longer term developmental outcomes to age 39 months of a parent-mediated video-aided intervention between 9-14 months for infants at familial risk for autism.
Methods: Â Two-site, two-arm assessor-blinded randomised controlled trial a 12-session therapist-delivered, parent-mediated social communication intervention delivered between 9 and 14 months of age (iBASIS-VIPP), against no intervention. iBASIS-VIPP is a modification for the autism prodrome of the Video Interaction for Promoting Positive Parenting (VIPP) programme. The home-based intervention uses video-feedback to help parents understand and adapt to their infant's individual communication style so as to promote optimal social and communicative development. iBASIS-VIPP extended the original 6 session VIPP program by adding up to six planned booster sessions according to need in discussion with family, and added therapeutic procedures to address any emerging developmental atypicality.Â The sample was 54 infants (28 intervention, 26 non-intervention) at familial risk of autism but not otherwise selected by developmental difficulty. Assessments were at 9-month baseline, 15-month treatment endpoint, and 27 and 39-month follow-up. Primary outcome was the level of emergent autism-related behaviour ('prodromal symptoms'), blind-rated on Autism Observation Schedule for Infants **(**AOSI) or Autism Diagnostic Observation Schedule (ADOS-2) across the four assessment points. Secondary outcomes were: blind-rated parent-child interaction (parent non-directiveness on the Manchester Assessment of Caregiver-Infant Interaction (MACI), parent synchrony on Dyadic Communication Measure for Autism (DCMA), child attentiveness on MACI and child initiations on DCMA). Other outcomes were child language (Mullen); non-blind parent-rated communication and socialisation (Vineland). Pre-specified intention to treat analysis combined estimates from repeated measures within correlated regressions to give an estimate of the overall effect of the infancy intervention. To summarize the treatment group differences in a principled fashion, the multiple point estimates were combined into an estimated area between the curves over time (sum of trapeziums, Figures 1 and 2). Trial registration: ISRCTN 87373263.
Results: Effect estimates for the autism prodromal symptoms, largest at 27 months, had confidence intervals at each separate time point including the null, but showed a significant consistent reduction when considered over time (ES=0.32; 95% CI 0.04, 0.60; p=0.026; Figure 1a). Significant overall effects through time were also seen on proximal intervention targets of parent non-directiveness/synchrony (ES=0.33; CI 0.04, 0.63; p=0.013; Figure 1c) and child attentiveness/communication initiation (ES=0.36; (95% CI 0.04, 0.68; p=0.015; Figure 1b). There was no effect on categorical diagnostic outcome, nor on other developmental or language measures (Figure 2a-d).
Conclusions: To our knowledge this is the first study of prodromal intervention for infants at risk, which has focused on emerging autism-related prodromal symptom trajectories and other dyadic treatment targets through 3 years. We demonstrate evidence of a treatment effect, extending after intervention, consisting of significant reduction in the overall level of emergent autism-related behaviours over time and enhanced parent-child dyadic social communication. The study highlights the value for early intervention trials of extended follow-up and repeated assessments within extended follow-up.

1:57 **116.002** Randomized Controlled Trial: Joint Attention Mediated Learning

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Background: Our primary aim was to determine the efficacy of the Joint Attention Mediated Learning (JAML) intervention for promoting joint attention between toddlers with autism spectrum disorders (ASD) and their caregivers and to determine maintenance effects. The JAML program is a parent-mediated, relationship-based, developmentally oriented intervention focused primarily on supporting joint attention learning. The research was conducted from sites in Indiana, Kansas/Missouri, and North Carolina.
Objectives: Our objectives were to assess JAML's: (a) effects on preverbal social communication for toddlers with ASD (b) social validity, and (c) maintenance of effects across time.
Methods: 127 toddlers, aged 16 to 30 months, and their parents participated in a randomized controlled trial to assess effects of JAML on four preverbal social communication outcomes: focusing on face (FF), turn-taking (TT), responding to joint attention (RJA), and initiating joint attention (IJA). Eligibility was determined by the ADOS-T. Principles of mediated learning supported parents' conceptual learning and their promotion of preverbal social communication targets for their toddlers. Experimental group participants received 32 weeks of individualized home-based support to promote their toddlers' social communication. Following post-assessment, control participants received instruction on the independent use of JAML materials. Using the Precursors of Joint Attention Measure (for which reliability had been established), coders blinded to group assignment observed intervals of parent-child interaction videos for the occurrence of targeted outcomes.
Results: Experimental and control groups showed no significant differences on pre-intervention measures; however, strong evidence of differential change between groups over time (in favor of the experimental group) was found from pre- to post-test for all four outcomes. These differences remained at six-month follow-up for FF, TT, and RJA. Post-assessment differences showed effect sizes of 1.24 post-intervention and 1.06 at 6-month follow-up for FF, .95 and 98, respectively, for TT, 2.80 and 4.71, respectively for RJA, and .85 and .57, respectively, for IJA. Inter-observer agreement (Kappa) reliability from blinded coders was .81 for FF, .72 for TT, 69 for RJA, and .74 for IJA. Parent and interventionist implementation fidelity with their intervention protocols was 98.6 and 99.5%, respectively, for ratings of satisfactory or better quality. Inter-observer agreement was 99% on both parent and interventionist fidelity measures. In an assessment of social validity (acceptability to parents) for those receiving JAML, a large majority strongly agreed with the acceptability and importance of JAML's goals, the parents' active role in the intervention, the support received to promote their toddlers' learning, their toddler's progress in the intervention, and their hopefulness about the child's future and confidence in their own ability to promote their children's learning. Descriptive data on other services received will be presented.
Conclusions: Joint attention, a competency associated with later language, social, and cognitive competence, is an achievable goal for toddlers with autism. Parents were able to translate key content and process components into everyday interactions. JAML's developmental focus, beginning with social regard for others' faces and proceeding to more advanced forms of preverbal social communication, maps onto emerging findings on early differences in social orientation in autism.

2:09 **116.003** Strengthening the Effects of Parent-Delivered Early Start Denver Model: A Randomized Controlled Multisite Trial

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Background: A previous RCT of parent implementation of ESDM (P-ESDM), did not demonstrate an ESDM advantage compared to community treatment. The design was confounded by significantly more outside treatment in the community group. The current study was designed to contrast two groups receiving active ESDM treatment to increase the likelihood that amount of outside treatment families took up would be similar. We compared standard P-ESDM (one clinic visit per week, written and verbal materials) to an enhanced approach involving two visits per week, clinic and home, and multimodal teaching methods).
Objectives: Compare effects of the standard and enhanced versions of P-ESDM on parent skills over the treatment period; examine longitudinal relationships between parent acquisition of ESDM skills and child developmental change .
Methods: A multisite RCT enrolled 48 children ages 12-30 months diagnosed with ASD, without other medical diagnoses, with DQs above 35. Thirty children completed the study, 13 in the standard and 17 in the enhanced group. Both groups received 12 weeks of parent coaching and 12 weeks of follow-up. The ESDM Parent Fidelity Implementation measure and an adapted version of the ESDM Curriculum Checklist were administered and scored 8 times by trained staff naïve to group assignment and hypotheses.
Results: Generalized linear mixed models (GLMM) were used to model longitudinal trajectories of outcomes, with main effects of treatment group and time, treatment by time interactions and subject level random intercepts and slopes. We found a significant interaction effect between treatment group and time on parent fidelity scores ($t(160)=3.23$; $p=0.0015$; Enhanced group: Estimated Mean Baseline: 3.28, Estimated Mean at End of Treatment: 3.81; standard group: Estimated Mean Baseline: 3.37,Estimated Mean at End of Treatment: 3.20). Improving parent fidelity scores occurred only in the enhanced ESDM group (See Figure 1)
Using the same GLMM approach, we found that both groups of children showed improvements in child checklist score ($t(217)=12.01$; $p<.0001$) (enhanced group: Estimated Mean Baseline: 0.35; Estimated Mean at End of Treatment: 0.51; standard group Estimated Mean Baseline: 0.38, Estimated Mean at End of Treatment: 0.50). Baseline ADOS ($\beta=-.057\pm.0012$ $t=-4.65$ $p<.0001$) and Mullen scores ($\beta=.0076\pm.0015$ $t=5.18$ $p<.0001$) were significant covariates. Covariates of mother's education level, age of subject, and average hours of outsideintervention were not significant . Group and time interaction for child change on the checklist wasÂ not significant ($t(215)=1.55$; $p=0.122$).
Â To examine relationships between parent and child change, we regressed the GLMM predicted subject-specific checklist slopes on the predicted subject-specific parent fidelity slopes. A significant association was found ($\beta=.051\pm.015$, $t=3.35$, $p=.0021$).Â
Conclusions: Â Parents in the enhanced P-ESDM demonstrated significantly faster rates of learning and greater fidelity than did parents in standard ESDM. The significant association between parent and child slopes suggests that the children of parents who showed improvement over time (enhanced group) show more rapid improvements on checklist scores over time, than did children whose parents do not show fidelity improvement over time (standard group). However the association between parent and child improvement was not as strong within the standard ESDM and enhanced ESDM groups.

2:21 **116.004** Enhancing Social Motivation in Inclusive Settings: Outcomes from a Randomized Controlled Trial for Preschool Children with Autism Spectrum Disorder

G. W. Gengoux[1]*, J. M. Hopkins*[2]*, R. K. Schuck*[1]*, M. E. Millan*[1] *and A. Y. Hardan*[1]*, (1)Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA, (2)PGSP-Palo Alto University, Palo Alto, CA*

Background: Studies of children with autism spectrum disorder (ASD) have repeatedly documented low rates of social initiations especially to peers, even among children without intellectual disability. Given existing support for motivation-based interventions in improving communication and reducing problem behavior, an important next step is to investigate how these techniques can be applied during social skills treatment to increase initiations with peers.
Objectives: This presentation reviews data from a randomized controlled pilot trial of a social group intervention aimed at motivating children with ASD to initiate interactions with peers.
Methods: Participants included 32 children with ASD (30 males; 2 females) ranging from 4-6 years old (M=5.16) assigned to one of two conditions: Social Initiation Motivation Intervention (SIMI; n=18) or Delayed Treatment Group (DTG; n=14). Participants in the SIMI condition participated in 8 weekly 75-minute social group sessions with typically-developing peers. Adult facilitators arranged cooperative play activities so that children with ASD received frequent reinforcement of social initiations directly from peers. Participants in the DTG continued community treatment for the duration of the 8-week trial and were compared to participants in the SIMI condition at post-treatment.
Results: Group differences between participants in SIMI and DTG were assessed on five outcome measures following treatment: Clinical Global Impressions-Improvement Scale (CGI-I), Social Responsiveness Scale-2 (SRS-2), Quality of Play Questionnaire (QPQ), Vineland Adaptive Behavior Scales-II (VABS-II), Social Skills Improvement System (SSIS), and Aberrant Behavior Checklist (ABC). On the SRS-2, significant group differences were observed on the Severity of Symptom category ($F=4.249$, $p<0.05$), such that participants in the SIMI condition exhibited significantly lower overall ASD severity scores (M=2.00 Mild, SD=1.4) than participants in the DTG condition (M=3.25 Moderate, SD=0.97) following treatment. On the CGI-I, significantly greater improvement was observed in the SIMI group compared to DTG in the areas of Communication ($F=4.308$, $p<.05$), Social Communication Integration ($F=4.376$, $p<.05$), and Maladaptive Behaviors ($F=34.286$, $p<.05$). On the QPQ, significant group differences were observed in the number of playdates to which participants were invited by others ($F=5.534$, $p<.05$). Specifically, participants in the SIMI condition exhibited greater treatment gains in joint activities with peers such as computer/video games ($F=7.963$, $p<.05$), playing cards ($F=3.867$, $p<.10$), and watching tv/movies ($F=3.445$, $p<.10$), and exhibited decreased arguments ($F=5.264$, $p<.05$) and teasing ($F=7.004$, $p<.01$) during playdates than participants in the DTG condition. On the SSIS, participants in the SIMI condition exhibited greater change from baseline to post treatment in self control skills ($F=5.416$, $p<.05$) and overall socialization standard score rating ($F=8.394$, $p<.01$). Results did not reveal significant differences between groups on the ABC or VABS-II following treatment.
Conclusions: Findings from this pilot investigation suggest that the SIMI treatment focused on enhancing motivation to initiate to peers was effective in augmenting broad aspects of social functioning including improved social communication skills, reduced symptom severity, and greater frequency of joint play with peers during playdates. Implications for design of effective inclusive social skills programming and future research directions for improving meaningful social outcomes will be discussed.

Oral Session - 3B

117 - Important Factors in Early Interventions: Predictors, Sustainability and Follow up

2:40 PM - 3:30 PM - Yerba Buena 8

Session Moderator: Connie Kasari, *University of California, Los Angeles, Los Angeles, CA*

2:40 **117.001** Long-Term Symptom Reduction Following the Preschool Autism Treatment Trial RCT (PACT)

J. Green[1], *A. Pickles*[2], *T. Charman*[3], *A. Le Couteur*[4], *K. Leadbitter*[5], *E. Salomone*[6], *R. Cole Fletcher*[7], *H. Tobin*[5], *I. Gammer*[8], *J. Lowry*[9], *G. Vamvakas*[10], *S. Byford*[11], *C. R. Aldred*[5], *V. Slonims*[12], *H. McConachie*[13], *P. Howlin*[14] *and J. Parr*[15], *(1)University of Manchester, Manchester, United Kingdom, (2)King's College London, London, UNITED KINGDOM, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Northumberland, Tyne and Wear NHS Foundation Trust, Newcastle Upon Tyne, UNITED KINGDOM, (5)University of Manchester, Manchester, UNITED KINGDOM, (6)Institute of Psychiatry, London, UNITED KINGDOM, (7)University of Durham, Durham, United Kingdom, (8)Institute of Psychiatry, King's College London, London, UNITED KINGDOM, (9)Newcastle University, IHS, Newcastle Upon Tyne, UNITED KINGDOM, (10)Kings College London, London, United Kingdom, (11)Kings College, London, UNITED KINGDOM, (12)Evelina Children's Hospital Guy's and St Thomas' NHS Foundation Trust, London, UNITED KINGDOM, (13)Institute of Health and Society, Newcastle University, Newcastle upon Tyne, United Kingdom, (14)King's College London, Institute of Psychiatry, London, UNITED KINGDOM, (15)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom*

Background: Â It is not known whether early intervention can improve long-term autism symptom outcome.
Objectives: Â To determine long-term outcomes of the Preschool Autism Communication Trial (PACT). We hypothesised enhanced intervention effect on autism symptom outcomes, and continuation of effects on parent and child social interaction.
Methods: Â PACT tested a 12-month parent-mediated social communication intervention for children aged 2 - 4 years with severe autism (18 therapist-parent video-aided sessions and daily parent home-practice), randomized 1:1 against Treatment as Usual. We undertook follow-up ascertainment at all original trial sites (Manchester, Newcastle, and London, UK) at median 5·75 years (IQR 5·42–5·92) from the original trial endpoint. Pre-specified blinded primary outcomes were the Autism Diagnostic Observation Schedule Combined Severity Score (ADOS CSS); proportion of child dyadic initiatiations with parent from the Dyadic Communication Assessment Measure for Autism (DCMA), and an expressive-receptive language composite. Secondary outcomes included non-blinded parent-ratings of autism symptoms (SCQ), repetitive behaviours (RBQ), adaptive behavior (Vineland), and peer relationships (SDQ); teacher-ratings of adaptive behavior (Vineland). All analyses were by intention-to-treat. Study registration ISRCTN 58133827; funding UK Medical Research Council.
Results: Â 121 (80%) of the 152 trial participants (59 [77%] of 77 assigned to PACT intervention vs 62 [83%] of 75 assigned to treatment as usual) were traced and consented to be assessed. Mean age at follow-up was 10·5 years (SD 0·8). Group difference in favour of PACT on ADOS CSS was logodds effect size (ES) 0·64 (95% CI 0·07 to 1·20) at treatment endpoint and ES 0·70 (95% CI –0·05 to 1·47) at follow-up, giving a significant overall reduction in symptom severity over the course of the whole trial and follow-up period (ES 0·55, 95% CI 0·14 to 0·91, p=0·004; Figs 1 and 2). Figure 2 shows group time paths in relation to baseline (left) and TAU (right). DCMA child initiations at follow-up showed a Cohen's d ES of 0·29 (95% CI –0.02 to 0.57) in favour of PACT and was significant over the course of the study (ES 0·33, 95% CI 0·11 to 0·57, p=0·004). Non-blind parent-rated autism symptoms (ES 0·40, 95% CI 0·05, 0·77) and repetitive behaviours (ES 0·87, 95% CI 0·47, 1·35) showed comparable treatment effects (Fig 1). There were no group differences in the language composite (ES 0·15, 95% CI –0·23 to 0·53) or comorbid mental health problems.
Conclusions: Â This study supports the clinical value of the PACT intervention. It advances previous work by showing for the first time that a theoretically derived, developmentally targeted early intervention can have a sustained effect on autism symptom outcomes nearly 6 years after the end of treatment in a randomised trial. Such a sustained effect after time-limited intervention has implications for developmental theory and further research is needed to elucidate the developmental mechanisms. Strengths are the pre-specified ITT analysis on standard blinded outcomes and nearly 80% follow-up of one of the largest autism treatment cohorts. We cannot be sure how the results would generalized to milder autism spectrum disorder.

2:52 **117.002** Exploration of Prognostic and Predictive Factors of Outcome in Participants in the Preschool Autism Communication Trial (PACT)

V. Slonims[1], *A. Le Couteur*[2,3], *H. McConachie*[3], *K. Hudry*[4], *B. Barrett*[5], *P. Howlin*[6] *and .. PACT Consortium*[7], *(1)Evelina Children's Hospital Guy's and St Thomas' NHS Foundation Trust, London, England, United Kingdom, (2)Northumberland, Tyne and Wear NHS Foundation Trust, Newcastle Upon Tyne, UNITED KINGDOM, (3)Institute of Health and Society, Newcastle University, Newcastle upon Tyne, United Kingdom, (4)Olga Tennison Autism Research Centre, Melbourne, AUSTRALIA, (5)King's Health Economics, Institute of Psychiatry, London, UNITED KINGDOM, (6)King's College London, Institute of Psychiatry, London, UNITED KINGDOM, (7)United Kingdom*

Background: Recent systematic reviews and meta-analyses suggest benefits from various interventions for children with autism. However heterogeneity is a major barrier in evaluating treatment effectiveness and identifying what works for whom presents a continuing challenge.
Objectives: To explore this issue we exploited data from the large Pre-school Autism Communication Trial (PACT) (Green et al., 2010) which had treatment sites in three UK locations. Families were randomised to receive PACT or Treatment as Usual (TAU). We wanted to identify which baseline child and family factors might differentiate between children who improved on a measure of autism symptoms (ADOS-G) and those who did not, over the period of a year. A further aim was to attempt to distinguish between factors that influence outcome for all children (i.e. prognostic factors) from those due to the intervention (predictive factors).
Methods: Data from 152 families who were randomised to receive PACT or TAU at three UK sites were analysed. ADOS scores (Lord et al 2000) from baseline to end of study (146 children) were used to assess changes in autism symptomatology over time. Jacobson and Truax's (1991) Reliable Change Index (RCI) was used to identify children whose improvement or deterioration could be considered psychometrically reliable. The sample was divided into those children (n=43) who had made reliable improvement in ADOS scores over the trial period and those (n= 41) who had not.
Results: Baseline non-verbal ability was a significantÂ prognostic indicator, being greater among Improvers than Non-Improvers, irrespective of randomisation with moderate effect size (*d*=.46). No other child factors were prognostic or predictive of treatment outcome. Contingency analysis indicated that treatment group x outcome status varied by trial site (see table). TAU families in London site were less likely to have child Improvers than Non-Improvers, compared with London families receiving PACT or families at the other trial sites, irrespective of randomisation. Exploration of parent variables suggested that lower levels of parent synchrony during parent-child interaction was associated with a poorer outcome on ADOS score for children in the TAU group, especially in London, but this was not the case for the children receiving the PACT treatment.
Conclusions: Our data indicate the importance of separating prognostic from predictive factors when analysing intervention effects. Although non-verbal ability was related to prognosis more generally, it was not specifically associated with treatment outcome. No other significant factors were identified although analysis of family factors suggested that, for parents with more limited synchronous communication, PACT therapy – with its focus on supporting parent sensitive interaction with the child – may mitigate the odds of children with autism maintaining or increasing their levels of symptom severity. Continuing research in this area and the need to distinguish carefully between prognostic and predictive factors in intervention research is important if clinicians are to be able to make reasoned decisions regarding for whom a specific therapy might be more or less beneficial.

3:04 **117.003** Comparative Effectiveness of Two Province-Wide Intervention Models for Preschoolers with Autism Spectrum Disorder

I. M. Smith[1], *W. Ungar*[2,3], *H. Flanagan*[4], *B. D'Entremont*[5], *N. Garon*[6], *C. Waddell*[7], *S. E. Bryson*[8], *P. McDonnell*[9], *J. den Otter*[10], *F. Vezina*[11] *and N. Leger*[10], *(1)Autism Research Centre, Dalhousie University / IWK Health Centre, Halifax, NS, Canada, (2)Health Policy, Management and Evaluation, University of Toronto, Toronto, ON, Canada, (3)Sick Kids Research Institute, Toronto, ON, Canada, (4)IWK Health Centre, Halifax, NS, CANADA, (5)University of New Brunswick, Fredericton, NB, CANADA, (6)Mount Allison University, Sackville, NB, CANADA, (7)Simon Fraser University, Vancouver, BC, V6B 5K3, CANADA, (8)Dalhousie University, Halifax, NS, CANADA, (9)Psychology, University of New Brunswick, Fredericton, NB, Canada, (10)Education and Early Childhood Development, Gov't of NB, Fredericton, NB, Canada, (11)Health and Wellness, Gov't of NS, Halifax, NS, Canada*

Background: Many jurisdictions offer comprehensive early intensive behavioural intervention (EIBI) programs to families of preschoolers with ASD, with that diagnosis as the only eligibility criterion. Children in these programs receive many hours of individual intervention per week for extended periods. Many make significant gains, although there is ample evidence of variable outcomes, and high costs are associated with sustaining these intensive services in public systems. Little comparative information exists from either research or community contexts regarding alternative models of EIBI.
Objectives: To compare pre-intervention characteristics and post-intervention outcomes for preschoolers with ASD in two demographically similar provinces with ASD service models differing in intensity, duration, and treatment methods. Distinct from the comprehensive EIBI model followed in New Brunswick (NB), the Nova Scotia (NS) program relies on Pivotal Response Treatment as its foundation, is less intensive, and of shorter duration.
Methods: Â Participants were families of 311 children with ASD recruited from publicly funded EIBI in the Canadian provinces of NB (n = 134) and NS (n = 177). Parents rated their children's adaptive behaviour (Vineland Adaptive Behavior Scales-2), ASD symptoms (Social Responsiveness Scale-2), and maladaptive behaviour (Scales of Independent Behavior-Revised) at Time 1 (T1; pre-intervention) and / or Time 2 (T2; after a year of service); 42% contributed data at both times. Intervention providers documented services delivered to children.
Results: Â Compared to the NB group, NS children were older (55 vs. 48 mos) at T1, and had significantly lower levels of adaptive functioning (mean VABS-2 score of 74.2 vs. 80.6), higher levels of ASD symptoms (mean SRS Total of 72.0 vs. 66.3) and more frequent / severe maladaptive behavior (SIB-R Asocial Index of -7.79 vs. -3.58). Differences between VABS-2 scores at T1 and T2 for both provinces were examined in a multilinear mixed analysis (MLA). Independent variables were time, province, and province X time. Test age was covaried and was not significant, F (1, 469.63) = .160, p = .689. As expected, VABS-2 scores were higher at T2 than at T1, F (1, 451.375) = 5.143, p = .024. The interaction of Time X Province was not significant, F (1, 238.488) = 1.809, p= .180, suggesting no difference between provinces in mean degree of improvement from T1 to T2 (both gain approximately 5 standard score points, i.e., ½ SD). Both groups also showed improvements on some ASD symptoms and problem behaviour symptom measures (SRS-2 and SIB-R, respectively), with no significant differences in improvements between provinces.
Conclusions: Developmental and behavioural changes over one year of preschool ASD intervention services were similar in two adjacent Canadian provinces, with mean gains of about .5 SD in adaptive behaviour in both groups. These results were observed despite different treatment and service delivery models, as well as significantly different pre-intervention characteristics of the children served. These findings contribute to literature suggesting that the common elements of ASD interventions have important effects that may outweigh differences between models. Implications for policy, including cost-effectiveness, will be discussed.

3:16 **117.004** Sustaining Quality Implementation of a Targeted Social Communication Interventions in Authentic Community Settings: Paraprofessional Implemented Jasper with Toddlers

S. Y. Shire[1]*, W. I. Shih*[2]*, Y. C. Chang*[3]*, S. Bracaglia*[4]*, M. Kodjoe*[4] *and C. Kasari*[2]*, (1)University of California Los Angeles, Los Angeles, CA, (2)University of California, Los Angeles, Los Angeles, CA, (3)California State University, Los Angeles, CA, (4)New York Center for Child Development, New York, NY*

Background: Â Due to the gap between known efficacious interventions for young children with ASD and routine daily care, implementation science studies address questions about intervention acceptability, feasibility, and fidelity by community practitioners. While these studies are increasing in the literature, examination of the sustainability of such programs in ongoing real-world contexts is not often reported. The present project explores the sustainability of a targeted social communication intervention for toddlers with ASD when implemented and supervised by public early intervention providers.
Objectives: Â First, to explore maintenance of Teaching Assistants' (TAs') intervention implementation delivered to a second cohort of toddlers in an authentic early intervention setting with on-site community support and no support from the research team. Second, to compare change in children's initiations of joint attention (IJA) between the first supported year of the study and the second unsupported year of the study.
Methods: As part of a randomized trial, 78 children with ASD age 2-3 years (*M*age=31.71 months) received JASPER intervention in project Year 1 (Yr1). An additional 63 toddlers with ASD (*M*age=32.15 months) received JASPER in a second randomized trial- Year 2 (Yr2). Twenty-two TAs delivered JASPER in both YR1 and YR2. All TAs and all but 7 children were members of an ethnic minority group.
Intervention. In YR1, TAs were provided with intensive supports from the university team including two weeks of in-vivo training plus weekly feedback and support to deliver the Joint Attention, Symbolic Play, Engagement, and Regulation intervention (JASPER: Kasari et al., 2008; 2014; 2015). Significant effects on joint engagement, joint attention gestures, play skills, and language were demonstrated for JASPER over usual treatment (Shire et al., in press). In YR2, TAs were provided with on-site community supervision and no external support from the research team. Each child received JASPER for 30 minutes a day for 10 weeks in both YR1 and YR2. This is the first examination of the sustainability of community supervised, and community implemented JASPER with toddlers in center-based care (YR2).
Measures. Ten-minute TA-child interactions at 10-week exit were coded for TAs' JASPER implementation. Independent assessors also administered an assessment of children's spontaneous joint attention skills including gaze, gesture, and language (Short Play and Communication Evaluation: Shire et al., in press). The total number of spontaneous initiations of joint attention (IJA) was obtained from video coding of this assessment.
Results: Â In YR1, TAs' average JASPER implementation was 80.90% (*SD*=16.31%) by treatment exit. At YR 2 exit, TA's average implementation was 71.21% (*SD*=11.74%). Children's gains in IJA skills over treatment were significant in both YR1 (f(1,88)=40.84, p<.001) and YR2 (f(1,88)=33.74, p<0.001). Gains in IJA were not significantly different between Yr1 and Yr2 (f(1,88)= 0.02, p=0.89).
Conclusions: Through on-site community supervision, TAs maintained quality implementation of JASPER intervention with a new cohort of toddlers with ASD where toddlers in YR2 made comparable IJA gains to toddlers in YR1. This is one of the first studies to examine long-term implementation outcomes for an evidence-based social communication intervention with toddlers with ASD implemented by community paraprofessionals.

Oral Session - 4A
118 - Community-based Screening and Detection Methods
1:45 PM - 2:35 PM - Yerba Buena 9

Session Moderator: Celine Saulnier, *Children's Healthcare of Atlanta, Emory University, Marcus Autism Center, Atlanta, GA*

1:45 **118.001** Development of a Video-Based Instrument for ASD Screening in Infancy

S. Ozonoff[1]*, G. S. Young*[1]*, A. Belding*[2]*, S. Dvorak*[3]*, A. M. Hill*[2]*, M. M. Hill*[2]*, A. J. Schwichtenberg*[4] *and J. N. Constantino*[5]*, (1)Psychiatry and Behavioral Sciences, University of California, Davis, MIND Institute, Sacramento, CA, (2)UC Davis MIND Institute, Sacramento, CA, (3)Instructional and Educational Technology, UC Davis, Davis, CA, (4)Purdue University, West Lafayette, IN, (5)Department of Psychiatry, Washington University School of Medicine, St. Louis, MO*

Background: The most widely used method for ASD screening is parent report but recent studies have demonstrated low agreement with more objective measurements of ASD symptoms. Major sources of error in parent report are comprehension and interpretation errors, such as limited understanding of the constructs or knowledge of developmental milestones. The use of videos has been shown to dramatically increase clarity in other fields, from music instruction to motor vehicle repair; in this study we examined whether video also improves ASD screening.
Objectives: We developed the Video-Referenced Infant Rating System for Autism (VIRSA), a low-cost, low-burden, web-based ASD screening measure, and examined its psychometric properties and ability to predict autism outcomes.
Methods: The VIRSA consists of a large library of 20-second video clips of parents interacting with infants, distributed along a continuum from high to low social competence. Parents are shown a pair of videos and asked to choose the one most like their child. Depending upon which video is chosen, the next pair of videos is selected to narrow the search space, and this process is repeated until the ratings converge on a stable score. The VIRSA was administered at 6, 9, 12, and 18 months to parents of 90 infants at familial risk for ASD and 45 infants with no family history of ASD. The infants are followed to 36 months of age to determine diagnostic outcomes. Parents complete the VIRSA from home, immediately before the visit and one week later. Examiners complete the VIRSA immediately after the visit. Finally, parents complete the Infant Toddler Checklist (ITC), a screening instrument that uses written descriptions of behavior, providing a measure of convergent validity.
Results: Split-half reliability is good to excellent (*r*=.63 for parents, *r*=.86 for examiners). One-week test-retest reliability is good (*r*=.61), with parents selecting the same videos as the week earlier on 71.9% of paired comparisons. Inter-rater reliability is lower (*r*=.28) which was not unexpected, given the different contexts and expertise across parents and examiners. There is a significant main effect for the VIRSA as a predictor of the ITC,**Â** χ^2=579.64, p<.001. This suggests acceptable convergent validity, with the VIRSA indexing many of the same behavioral constructs as the ITC. To examine predictive validity we compared VIRSA scores of participants who are typically developing (n=135) to those with an ASD diagnosis (n=16) or for whom developmental concerns have been raised (Atypical group, n=18). As seen in Figure 1, VIRSA scores of the ASD group worsen over time, while those of the Typical and Atypical group are stable or increase with age (main effect of group,Â χ^2= 6.68, p<.05; group x time interaction, χ^2=6.41, p<.05. The ASD group differs significantly from the Typical group by 9 months and from the Atypical group by 18 months.
Conclusions: 1) The VIRSA has good psychometric properties. Parents provide consistent ratings over time, demonstrate moderate agreement with expert examiner ratings, and detect changing behaviors as their infants develop ASD. 2) These findings replicate the pattern of declines in development as ASD emerges that have been documented using other measures.

1:57 **118.002** Universal Screening for Autism in a Large Healthcare System: Diagnostic Outcomes after Age Four

W. Guthrie[1]*, M. Gerdes*[2]*, S. E. Levy*[3]*, J. Pandey*[1]*, R. T. Schultz*[1] *and J. Miller*[1]*, (1)The Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (2)Children's Hospital of Philadelphia, Philadelphia, PA, (3)The Children's Hospital of Philadelphia, Philadelphia, PA*

Background: Large-scale autism screening studies have yielded empirical support for early screening for ASD. However, they have not accurately estimated sensitivity, specificity, and negative predictive value (NPV), because children who screen negative have not been systematically followed through the risk period.Â The Children's Hospital of Philadelphia (CHOP) implemented universal screening for ASD documented in the Electronic Health Record (EHR) in 2009. As these children age and continue to be served within our healthcare system, we have the opportunity to follow children screened for ASD and fill important gaps in the screening literature.
Objectives: Estimate sensitivity, specificity, positive predictive value (PPV), and NPV in a large sample of children screened for ASD in primary care and followed until age 4-6 years using data from the EHR.
Methods: Universal screening of children age 16-30 months was conducted using the Modified Checklist for Autism in Toddlers (M-CHAT; Robins et al., 2001) at CHOP primary care clinics. Parents completed the M-CHAT and pediatricians were asked to complete the Follow-Up Interview when appropriate and document results in the EHR. Children were included if (1)the M-CHAT was completed between 16-30 months, and (2)the child presented to primary care for follow-up at ≥4 years. Diagnostic outcomes were abstracted from EHR records from pediatricians, developmental behavioral pediatricians, psychologists, psychiatrists, and neurologists within the CHOP system.
Results: 21,543 children were screened using the M-CHAT during routine clinical between 2010-2012. 77.96% had complete data recorded in the EHR and 59.44% returned for a subsequent CHOP primary care visit at ≥ 4 years. Of the 7,602 children with follow up information available, 6.77% screened positive for ASD on the M-CHAT and 2.10% had a documented diagnosis of ASD by age 4. Sensitivity was estimated at 38.12% and specificity was 93.90%. PPV was 11.84%, while NPV was 98.60%. When outcome was broadened to include any neurodevelopmental or psychiatric diagnosis (i.e., developmental/language delay, intellectual disability, ADHD, other behavior disorder, anxiety), PPV was 58.83% and NPV was 76.18%. The effect of child and family characteristics (i.e., age at screening, race, ethnicity, prematurity, SES, primary language spoken) on screening accuracy will be discussed.
Conclusions: This study is among the first to examine universal autism screening and subsequent outcomes within a large pediatric healthcare system. Important differences from previous large-scale screening studies include follow-up data after the primary risk phase on large numbers of children, andÂ “real world” use of the M-CHAT with diagnoses made by CHOP providers (or community diagnoses documented in the EHR by pediatricians) rather than assessments in the research lab. Our data suggest a substantial proportion of children with ASD were missed by universal screening at 16-30 months. Just as there is no single cause or effective treatment across the entire autism spectrum, there is likely not a single screening measure or screening age that will identify all individuals with ASD. Future research should determine the type of child best identified through traditional early screening, and what additional methods would enhance classification accuracy.

2:09 **118.003** Examining Disparities in Duration of Screening-to-Diagnosis Time in aÂ Multistage, Early Intervention-BasedÂ Screening Protocol for ASD

M. Feldman[1]*, L. Buitrago Sandoval*[1]*, A. Eisenhower*[1]*, R. C. Sheldrick*[2] *and A. S. Carter*[1]*, (1)University of Massachusetts Boston, Boston, MA, (2)Tufts Medical Center, Boston, MA*

Background: There are long-standing health disparities in early diagnosis of autism spectrum disorder (ASD) for children from poor, racial and linguistic minority families (Durkin et al., 2010; Mandell et al., 2009; Zuckerman et al., 2013). The implementation of universal screening protocols is one attempt to overcome these inequalities by engaging in regular developmental screening of all children, a practice recommended by the American Academy of Pediatrics (2006) and Centers for Disease Control (2012). It is not known whether the implementation of multistage universal screening procedures reduces health disparities in the duration of the screening, referral, and diagnostic evaluation process.
Objectives: To determine whether the implementation of a multistage universal screening and assessment procedure in Early Intervention (EI) settings will reduce disparities in age of receipt of ASD diagnosis by shortening the time between the onset of screening and the receipt of diagnosis.
Methods: Participants are families of children enrolled in EI who are between ages 14-33 months (N = 125, M_{age}= 24.7 months at Stage 1 of screening, 83% male). Children were evaluated as part of a 2-stage screening procedure administered by their EI specialists to identify children at risk for ASD; those at risk were referred for diagnostic assessment. Parents self-identified as racially (57% identify as racial minorities), linguistically (46% Non-English primary language) and economically (66% of families earn <$45,000/year) diverse. Parent demographics including self-identified race, English language proficiency, and household income were of interest. Duration of the screening and assessment process was measured as the time in days required to proceed from Stage 1 (parent completion of EI-administered ASD screening questionnaires), through Stage 2 (EI-administered play-based observation screener for ASD), and ending at Stage 3 (diagnostic evaluation). Analyses examined whether demographics predicted duration of screening protocol from Stage 1 to diagnostic evaluation.
Results: Mean duration of the screening and assessment process was 2.8 months (*SD* = 2.0). A linear regression was conducted to predict duration of the screening and assessment protocol based on demographic factors of race (dichotomized into White and non-White), English language proficiency (5-point scale), and household income (10-point scale). The overall model was significant, $F(3,121)=3.08$, $p=.03$, $R^2 = .07$. Income was the only significant predictor ($ß=-.215$, $t=-2.26$, $p=.03$); parent race and English proficiency did not predict duration. For families with incomes ≤$45,000, mean duration was 3.2 months, whereas for families with incomes >$45,000, time between initial screening and diagnostic evaluation was 2.1 months.
Conclusions: In a diverse, urban sample, children from lower income households were found to be at particular risk of delayed diagnosis, even after being identified at-risk. Despite utilization of a free, universal screening and diagnostic assessment procedure, inequity still exists within the screening system. Nonetheless, for poor families, overall duration was markedly shorter than the nearly eleven-month delay reported in other studies (Mandell, Novak, & Zubritsky, 2005). This finding has implications for professionals engaging in screening of young children, as professional biases and/or family stressors may be impacting fair and equitable use of universal screening protocols.

2:21 **118.004** Efficacy of the Social Communication Questionnaire in a Community-Based Sample of Toddlers

T. N. Day[1]*, W. Guthrie*[2]*, C. Nottke*[3] *and A. M. Wetherby*[3]*, (1)Clinical Psychology, Florida State University, Tallahassee, FL, (2)The Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (3)Florida State University Autism Institute, Tallahassee, FL*

Background: Â Previous research has demonstrated that ASD can be diagnosed in children younger than 2 years of age (Zwaigenbaum et al., 2015), yet the median age of diagnosis is currently over 4 years (Christensen et al., 2016).Â Given the AAP's recommendation for routine screening at 18-24 months (Johnson & Myers, 2007), most early screening measures target that age range (e.g., M-CHAT-R/F assesses children 16-30 months [Robins, Fein, & Barton, 2009]). There are limited screening measures for 2- and 3-year-old children, further contributing to the under identification of ASD before age 4. While the Social Communication Questionnaire (SCQ; Rutter, Bailey, & Lord, 2003) was intended for children 4+ years, its effectiveness has been examined in children under 4. When prioritizing the accuracy of identifying ASD (i.e., sensitivity≥80%), the rate of false positives was extremely high (i.e., specificity at 25% for a cut-off of 11) in children at-risk for ASD (Oosterling et al., 2010). The SCQ does not appear to perform optimally in young children, but further investigation is warranted.
Objectives: Â (1) Examine the effectiveness of the SCQ in a community-based sample of toddlers; (2) Maximize its efficacy for 2-3 year olds
Methods: Â Children were ascertained through screening in primary care using the Infant Toddler Checklist (Wetherby & Prizant, 2002) or Early Screening for Autism and Communication Disorders (Wetherby et al., 2015). Both negative and positive screens were included in the current sample (*N* = 384). Parents completed the SCQ–Lifetime Form when their child was 24-47 months; on items probing about ages 4-5, parents were asked to consider the last 12 months. Children received a concurrent diagnostic battery to determine a best-estimate diagnosis of ASD (*n*=181), DD (*n*=91), or TD (*n*=112).
Results: A receiver operating characteristic (ROC) curve analysis resulted in an area under the curve (AUC) of .694. At the recommended cut-off of 15, sensitivity for ASD was 40.9% and specificity was 85.7%. Prioritizing sensitivity in this sample (i.e., 81.2%) resulted in a cut-off of 7 and specificity of 42.9%. ROC curves were also conducted on individual items and 6 items had an AUC>.60, which assessed reciprocal conversations (item 2), unusual hand and body mannerisms (15-16), nodding head for 'yes' (24), offering comfort (31), and reciprocal imaginative play (39). These 6 items were summed, which resulted in an AUC of .757. A cut-off of 1 had a sensitivity of 88.9% and specificity of 39.1%.
Conclusions: Results indicated that a lower cut-off is needed for young children and demonstrated a shortened version of the SCQ may be more effective for children 2-3 years. A 6-item composite exhibited moderately better sensitivity and comparable specificity than all 40 items at a cut-off of 7, and was substantially better than the known cut-off of 15. Both versions of the SCQ demonstrated a high rate of false positives indicating further assessment of ASD is warranted, but suggested utility for identifying ASD. Confirmatory factor analyses and examination of measure performance by developmental level and age will provide more insight into the most useful SCQ items in toddlers.

Oral Session - 4B
119 - Gender Differences in ASD
2:40 PM - 3:30 PM - Yerba Buena 9

Session Moderator: Celine Saulnier*, Children's Healthcare of Atlanta, Emory University, Marcus Autism Center, Atlanta, GA*

2:40 **119.001** Gender Differences in ASD through a Developmental PRISM

C. Shulman*, The School of Social Work, Hebrew University of Jerusalem, Jerusalem, Israel*

Background: In both Kanner's and Asperger's original samples, males were dominant: eight of the eleven children Kanner described and all four of Asperger's children were male. Over the past two decades, a trend towards decreasing male-predominance has emerged (Jensen, Steinhausen, & Lauritsen, 2014), with recent epidemiological studies showing a 3:1 male-female ratio (Werling & Gerschwind, 2015). Females with autism may be under-identified and underrepresented, resulting in a possible male-biased understanding of autism. The present research is an attempt to understand ASD characteristics in young females, and to specify cognitive profiles and ASD symptomatology at the time of diagnosis and three years later.
Objectives: This longitudinal study compares cognitive and ASD profiles of boys and girls in their third year of life and again at age six in order to address gender similarities and differences over time.
Methods: Sixteen girls and 50 boys with suspected ASD were assessed before age three (girls' ages in months: M = 26.377, SD = 3.224; boys' ages in months; M = 27.127, SD = 2.873) and again at around age six (girls: M = 69.382, SD = 4.538; boys: M = 72.452, SD = 4.296). At first assessment, before age three, cognitive abilities of all participants were assessed with the Mullen Scales of Early Development and the ASD profile was assessed with the ADOS toddler module. Cognitive abilities around age 6 were assessed with either the Wechsler Preschool and Primary Scales of Intelligence or the Mullen Scales of Early Development, and ASD profiles with the appropriate ADOS Module.
Results: Although there were no significant differences between the males and females at the initial assessment (girls' DQ: M = 66.21, SD = 12.74; boys' DQ: M = 62.968, SD = 14.673), a difference emerged around the age of six, with the girls' IQ being significantly lower than that of the boys (girls: M = 77.987, SD = 22.158; boys: M = 103.442, SD = 31.945). Similarly, differences emerged in autism symptomatology around age six, although no significant differences appeared before age three. By age six, the ADOS profiles of girls revealed fewer social-affective symptoms and fewer restricted and repetitive behaviors.
Conclusions: By age six, the gender differences evident in cognitive profiles and ASD symptomatology are similar to those documented in previous research despite the fact that no gender differences emerged around age three. Incorporating language, behavioral and cognitive factors in the longitudinal study of gender in ASD may shed light on diverging developmental trajectories in males and females with ASD. In order to understand ASD it is important to recognize the implications of a possible male bias, which may make it difficult to identify females with ASD, particularly at an early age.

2:52 **119.002** Differences By Gender in Rate of Autism Recurrence

I. A. Cox[1], *J. A. McGillivray*[2], *J. Manjiviona*[3], *D. T. Bulhak-Paterson*[4] *and M. A. Stokes*[5], *(1)Schol of Psychology, Deakin University, Burwood, AUSTRALIA, (2)School of Psychology, Deakin University, Burwood, AUSTRALIA, (3)Private Practice, Melbourne, AUSTRALIA, (4)Private Practice, East Malvern, Australia, (5)School of Psychology, Deakin University, Melbourne, Australia*

Background: Â Males with Autism Spectrum Disorder/Condition (ASD/ASC) outnumber equivalent females. Reasons for the gender disparity remain speculative. The historical conceptualisation of autism has shaped current diagnostic criteria and assessment tools, which may be insensitive in detecting female characteristics. Socialised gender roles and mechanisms adopted by females with ASC that obscure symptoms and underpin the 'camouflage hypothesis', may influence the sex skew. Such factors may lead to under diagnosis, misdiagnosis, or delayed diagnosis of ASC in females, precluding early intervention benefits and enhancing risk of adverse outcomes.
Objectives: This prospective investigation of school-aged children sought to explore the camouflage hypothesis by determining whether previously unidentified (PU) children with at least one older or younger sibling diagnosed with ASC show differential rates of diagnosis by gender. If more PU female siblings than PU male siblings of child probands with ASC screen positive for ASC traits, this would add support to the camouflage hypothesis.
Methods: Clinicians with expertise in ASC in the state of Victoria, Australia, were asked to identify potential participants from their case files and forward research invitations to them. Advertising through ASC agencies also facilitated recruitment. Forty siblings (*females*=20) aged 6 to 17 years of child probands with a clinical diagnosis of ASC, and their parents, participated in the study. Child participants were assessed on cognitive ability (WASI-II), language (CELF-IV: Screener), behavioural presentation: *Immediate* (ADOS-2); *Recent* (AQ), and *Lifelong* (developmental history), adaptive functioning (VABS-II: Parent or Caregiver Rating Form), and female ASC attributes (GQ-ASC). Questionnaires were parent reported. Positive screens for ASC were determined by above cut-off scores on measures and clinical judgement, aligned with DSM-5 criteria for ASD.
Results: Based on previous literature it was expected that 18.7% of siblings, 26.2% of male siblings and 9.1% of female siblings of child probands with ASC would screen positive for the condition. Compared to expected estimates, the recurrence rate almost doubled for siblings of child probands with ASC in this study, with no difference in recurrence rate found for PU male siblings (30%), z =.376, *p*=.353, yet a highly significant difference in recurrence rate identified for PU female siblings (40%), z=4.26, *p*=<.001. The recurrence rate for PU males did not differ significantly from that of PU females (*z*=0.66, *p*=0.51).
Conclusions: In families with ASC probands, the sibling recurrence rate of ASC in school aged children is higher than previously reported in infant siblings. More PU female siblings screened positive for ASC than PU male siblings, unexpectedly resulting in a narrower and reversed sex ratio. The recurrence rate for PU males corresponds with existing research, whereas, the recurrence rate for PU females reflects a four-fold increase from the earlier estimate, endorsing the camouflage theory. Implications of these findings regarding developmental manifestation of ASC, sibling assessments, and diagnostic considerations will be discussed.

3:04 **119.003** Sex Differences in Children Referred for Assessment: Utilizing the Autism Mental Status Exam (AMSE)

R. A. Oien[1,2], *S. Vambheim*[1], *A. Nordahl-Hansen*[3], *L. A. Hart*[2], *M. Eisemann*[1], *F. Shic*[4] *and D. Grodberg*[2], *(1)Psychology, The Arctic University of Norway, Tromso, Norway, (2)Child Study Center, Yale School of Medicine, New Haven, CT, (3)Special Needs Education, Oslo University, Oslo, NORWAY, (4)Seattle Children's Research Institute, Seattle, WA*

Background:
Several studies have noted that female diagnosed with ASD exhibit a higher severity of symptoms than males (e.g. Øien et al. 2016). One suggestion for this difference is that females with the same levels of autistic traits as males might fail to meet diagnostic criteria due to sex-specific differences in trait expression (Dworozynski et al. 2012). Recently, we have found that female toddlers with ASD express a relative strength in joint attention, but a relative weakness in imitation compared to male toddlers with ASD (Øien et al., 2016). In the present study we address sex differences in observed behavioral symptoms utilizing the Autism Mental Status Exam (AMSE). The AMSE is a free (brief) standardized diagnostic assessment that structures the observation and documentation of eight items comprising social, communicative, and behavioral signs and symptoms of ASD that typically emerge throughout a neuro- developmental evaluation (Grodberg, Weinger, Kolevzon, Soorya, & Buxbaum, 2012; Øien, Weinger, Kolevzon & Grodberg 2016).
Objectives:
To evaluate sex differences in parent and clinician reported ASD specific symptoms in a sample of children referred to clinic for ASD assessment.
Methods:
The source population for this study included all patients receiving comprehensive autism-focused diagnostic evaluations, as part of the Assessment Core protocol at the Seaver Autism Center for Research and Treatment from September 2013 through December 2014. The total sample comprised of N=123 children with a mean age of 5.74 years (S.D.= 2.88). Sixty-two males and 23 females received a DSM-5 guided consensus diagnosis of ASD. The AMSE was administered in children first, before they were administered the reference standard (ADOS, ADI-R). ANOVA was used to compare the proportion of total scores on the AMSE between males and females in the groups. Mann-Whitney U non-parametric tests were used to analyse which items most frequently failed by males and females receiving an ASD diagnosis.
Results:
A one-way ANOVA revealed no differences on total AMSE score between males and females. Mann-Whitney U tests were conducted to ascertain differences on item level between male and female toddlers receiving an ASD diagnosis. The analysis revealed that ASD females performed worse than males on language (P=.005). Furthermore, the analysis showed that ASD females had fewer problems related to oversensitivity than ASD males (P=.025)
Conclusions:
The present study found that females performed worse than males on language, and thus it may be the case that females with the same level of general language difficulty as male peers fall under the diagnostic thresholds for ASD due to the presence of fewer sensory issues disrupting social interaction. It is important to stress that this viewpoint is still highly theoretical, and that nuanced patterns of behavioural differences are present in girls with ASD as compared to males through childhood. Results suggest that nuanced patterns of behavioral differences are present in girls with ASD as compared to boys with ASD through childhood.

3:16 **119.004** Sex Differences in Cognitive and Reasoning Abilities Among Preschool and School-Age Autistic Children

V. Courchesne[1]*, D. Girard*[2]*, C. Jacques*[3] *and I. Soulières*[4]*, (1)University of Montreal, Montreal, QC, Canada, (2)Université du Québec à Montréal, Montreal, QC, CANADA, (3)University of Quebec in Outaouais, Gatineau, QC, Canada, (4)University of Quebec in Montreal, Montréal, QC, Canada*

Background: The estimated IQ of individuals on the autism spectrum (AS) differs depending on the intelligence test used. The most replicated finding is the discrepancy between Wechsler Intelligence Scales and Raven Progressive Matrices (RPM), in favor of the latter. Some authors also suggested that IQ in AS children differs between girls and boys, girls tending to have more intellectual impairment than boys (Volkmar et al. 1993). However, other authors reported no discrepancy between the IQ of girls versus boys with autism (Mandy et al. 2012). It is therefore unclear whether the Wechsler-RPM discrepancy characterizes the cognitive profile of both AS girls and boys.
Objectives: 1) To examine whether there are sex differences in performance on Wechsler and on RPM within an AS and a typically developing (TD) group. 2) To compare the discrepancy between Wechsler and RPM between sexes and groups.
Methods: 48 AS children (25 males, 23 females) aged from 4 to 12 years old (*M*=7.54) and 66 TD children (37 males, 29 females) aged from 4 to 12 years old (M=6.15, *p*=.13) were assessed using the colored version of the RPM and either the WPPSI-IV (n=18 AS and 29 TD) or the WISC-IV (n=32 AS and 37 TD) depending on their age. A "Wechsler IQ" variable was computed by taking the score of either the WPPSI-IV or the WISC-IV depending on which test the child completed. A discrepancy variable was computed by calculating the difference between Wechsler and RPM in percentiles.
Results:
Regarding results on the Wechsler, an ANOVA showed a main effect of group ($p<.001$), AS children having a significantly lower performance (*M*=16.66, *SD*=25.37) than TD children (*M*=60.80, *SD*=30.87). There was no main effect of sex ($p=.14$) and no interaction effect ($p=.15$). On the RPM, the ANOVA showed no main effect of group ($p=.13$) or sex ($p=.29$). There was a significant interaction ($p<.05$), autistic boys (M=82.00, SD=27.00) performing better than autistic girls (M=66.42, SD=32.37; $p<.05$), while no difference was found between TD girls and boys.
Furthermore, for the discrepancy variable, there was a main effect of group ($p<.001$) and sex ($p<.01$), with no interaction effect ($p=.52$). The discrepancy between Wechsler and RPM was greater in the AS group (*M*= 57.42, *SD*=3.58) than in the TD group (*M*=19.54, *SD*=3.07), and that discrepancy was greater in boys (*M*=44.88, *SD*=3.21) than in girls (*M*=32.08, *SD*=3.46) from both groups.
Conclusions: The present results first replicated Mandy et al. (2012) findings that boys and girls on the AS do not differ in terms of Wechsler IQ in a sample of preschool and school-aged AS children. In addition to the existing literature, the results show that the difference between boys and girls with autism might be different depending on the test used. Finally, the investigation of sex differences in the RPM-Wechsler discrepancy suggests that this discrepancy characterizes the cognitive profile of AS children of both sexes, but might be smaller among girls (both TD and AS).

Oral Session - 5A
120 - Services and Systems for Children and Adults with ASD
1:45 PM - 2:35 PM - Yerba Buena 10-14

Session Moderator: Lauren Brookman-Frazee*, University of California, San Diego, La Jolla, CA*

1:45 **120.001** School and Employment Effects on Pathways to Service Use in Emerging Adults with ASD

J. Lai[1] *and J. A. Weiss*[2]*, (1)Psychology, York University, Montreal, QC, CANADA, (2)York University, Toronto, ON, CANADA*

Background:
With a large cohort of individuals with ASD reaching adulthood, there is pressing need to understand the dynamics of service utilization through the emerging adulthood period. This age cohort has high unmet service need and access to these services is an important predictor of quality of life for adults with ASD. Various clinical and systemic factors are known to contribute to service receipt across the lifespan, but to date, no one has investigated the dynamics of service use in this specific age group. Further, it is unclear how participation in further education or securing employment impacts service receipt through these factors.
Objectives:
In this study, we report on differences in service receipt in young adults with ASD-only compared to ASD+ID and examine if continuing in school/having employment moderates the relationship between having an ID in addition to ASD on service receipt and if so, by what mechanism.
Methods:
An online survey was administered across Canada through the Canadian Autism Spectrum Disorders Alliance, completed by caregivers reporting on young adults (ages 18-25) with ASD-only (n=251) or ASD+ID (n=333). We collected sociodemographic data (including current schooling/employment status), clinical need (including mental health, behavioural problems, overall function), and systemic variables related to service receipt (including barriers to services, caregiver-directed services). Current service use was operationalized as any service used in the last 6 months. We used a moderated mediation model to investigate the impact of having schooling and employment, after high school, on factors that influence service receipt.
Results:
Our results show that young adults with ASD+ID receive more services (ASD-only: 1.82 SD=1.87, ASD+ID: 3.28 SD=2.74; t=7.29, p<.001). There was a direct effect of having ID on the number of services received (Beta=1.23, SE=.2, CI: .84, 1.62, p<.001), while there was no direct effect of being in school or having employment (Beta=.21, SE=.21, p=.32). In the model, the increase in services was partially mediated by higher rates of both behavioural concerns (t=5.35, p<.001) and caregiver-directed services (t=2.83, p=.005) in those with ASD+ID compared to those with ASD alone. However, being in school or having employment moderated those factors, such that when one is in school/employed, only behavioural concerns was related to more services (Beta=.13, SE=.07, CI: .02, .30) and when one was not in school/employed, caregiver-directed services mediates the increase in service receipt for those with ASD+ID (Beta=.21, SE=.13, CI: .03, .57).
Conclusions:
These results suggest that contextual factors play a role in explaining why adults with ASD+ID may receive more services than young adults with ASD alone. When adults with ASD+ID remain in school or in an employment setting, higher rates of behavior problems can trigger referrals to additions supports. When a young adult with ASD+ID is not in school or employed though, caregiver-directed services explain why they access more services compared to individuals with ASD alone. Once individuals with ASD+ID transition out of school and are not yet involved in a vocational setting, parent support services becomes a pathway to service receipt.

1:57 **120.002** Access to Justice: Legal Professionals' Experience and Knowledge of Autism in Family Courts in England.

A. Remington[1], *L. Crane*[2] *and R. George*[3], *(1)Centre for Research in Autism and Education (CRAE), UCL Institute of Education, University College London, London, United Kingdom, (2)Goldsmiths, University of London, London, UNITED KINGDOM, (3)Faculty of Laws, University College London, London, United Kingdom*

Background:
Access to justice is a key issue for many sectors of society, but can be particularly problematic for autistic individuals. This is because many aspects of the condition (e.g., inability to decode non-verbal cues, difficulties understanding non-literal language and subtext) render autistic people vulnerable to being taken advantage of in negotiation or dispute settings. In addition, a departure from daily routine, and lack of control of the situation can cause autistic individuals a great deal of distress. The family court and the wider family justice system (i.e., the lawyers, judges and others responsible for assisting families and resolving legal disputes within families) makes a particularly strong example of these issues because interpersonal relationships are often the foundation of the dispute, while the processes involved have strict (but socially unusual) rules about behaviour, language, and the roles of the individuals within the system.
Objectives:
Research highlights high levels of dissatisfaction amongst autistic people and their families who have experienced the criminal justice process, and a number of service providers offer autism-specific guidance on navigating the criminal justice system. However, criminal court processes are quite different from other areas of the justice system, making it questionable the extent to which lessons learnt from that area are directly translatable to other contexts such as family law. To address this, the present study aimed to examine the current autism knowledge and experiences of legal professionals in the English family justice system.
Methods:
Questionnaires (online and paper versions) were distributed to legal professionals across England, asking about 1) their professional background and experience working with autistic individuals, 2) knowledge of autism (diagnostic criteria of autism, descriptive characteristics and co-occurring behaviours) and 3) their perceived self-efficacy (their confidence in their ability to identify and work with autistic clients). A small follow-up study was conducted with 10 family justice professionals, using qualitative interviews to explore their experiences of cases involving autistic litigants.
Results:
197 legal professionals (barristers, solicitors, judges) from across the UK completed all parts of the survey. 58% of respondents reported that they had knowingly worked with autistic individuals, yet 91% indicated that they had never received training regarding the condition. Scores on the autism knowledge questionnaire were high: with an average score of 84% correct, and were slightly higher for the 44% of respondents who had a personal connection with autism. Despite the high levels of knowledge, legal professionals reported low levels of confidence in their ability to support autistic individuals in their practice. Interview data revealed a range of concerns and best practice suggestions.
Conclusions:
Our findings suggest the need for targeted training materials to help legal professionals work more effectively with their autistic clients. Specifically, the current study highlights the discrepancy between low practical confidence and high theoretical knowledge, a finding that can be used to inform the creation of best-practice resources to help bridge that gap.

2:09 **120.003** Examining Part C Early Intervention Services for Families with Children at Risk- or with Autism Spectrum Disorder

A. Aranbarri[1], *M. E. Miller*[1], *A. C. Stahmer*[2] *and S. J. Rogers*[1], *(1)University of California, Davis. MIND Institute, Sacramento, CA, (2)Psychiatry and Behavioral Sciences, UC Davis MIND Institute, Sacramento, CA*

Background: Â As the rates of AutismÂ Spectrum Disorder (ASD) continue to increase and ASD pediatric screening efforts intensify, more infants and toddlers are entering the Part C system (e.g., Corsello, Akshoomoff, & Stahmer, 2012). Part C service delivery to toddlers with ASD varies greatly across states, rural/urban settings and family resources (Stahmer & Mandell, 2006). Research recommends receiving 20 or more hours per week of specialized evidence-based intervention for young children with ASD to achieve optimal outcomes—reducing intellectual impairment, improving social communication/skills and language development— (e.g., Dawson et al., 2010, Lord and McGee, 2001). However, Part C providers tend to use general developmental guidance which is not effective for ASD (Ingersoll et al., 2012). It is assumed that evidence-based practices are not the norm, and are especially difficult to access in low resourced areas. To improve community services to under resourced children with ASD, a better understanding of the current Part C system service delivery is needed.
Objectives: Â To obtain a comprehensive understanding of the early intervention delivery system for children with or at-risk for ASD at multiple levels of the Part C delivery system, across states and family income level.
Methods: Â Participants include 5 state Part C coordinators, that nominated 10 agency administrators serving mainly low resource areas, whoÂ nominated 20 early intervention providers within those agencies, that finally nominated 32 caregivers of children with or at-risk for ASD. A semi-structured on-line survey was conducted at these multiple levels. Descriptive and contingency analyses were conducted to explore the objective of the study.
Results: Â Lower income families report receiving one-third of the intensity of higher income families, with less access to specialized treatments. Despite this, lower income families report higher rates of satisfaction. Agency Administrator's and Provider's reports of service intensity are consistent with the caregiver's reports, while Part C coordinators overestimated the service intensity and quality provided to lower resources areas. Both Part C coordinators and Agency Administrator showed very little training in ASD. The home setting was consistent among the 3 administrative levels to be the principal delivery setting. In general, there were neither specific methods used for early intervention in ASD nor for parent training. These results highly vary among states.
Conclusions: Â Results suggest that special efforts are needed to increase evidence-based ASD training for Part C providers serving low income families and low resource areas to improve care for this population. Results also showed the need of stronger advocacy for lower income families, both in service quality and intensity needed. Data will be used to adapt an evidence-based practice that has previously shown efficacy in a randomized clinical trial. The adaptation will target the needs of rural and low resourced areas and will fit within the frame of the current Part C delivery system.

2:21 **120.004** Impact of State Autism Insurance Mandates on Healthcare Utilization and Insurance Expenditures Among a Commercially Insured Population with Autism Spectrum Disorder in the United States, 2008 – 2012.

***P. Nichols**, C. J. Alverson, D. Christensen, M. Yeargin-Allsopp, K. Nyarko, N. Dowling and S. Grosse, Centers for Disease Control and Prevention (CDC), Atlanta, GA*

Background: Â Insurance mandates for autism services are legislated in 46 states. Despite concerns about impact on costs to insurers, no research has evaluated the financial impact of these mandates on health plans.Â
Objectives: To identify differences in healthcare utilization and insurance expenditures for children with autism spectrum disorder (ASD) attributable to insurance mandates, overall and for the following service types: general outpatient, behavioral and mental health outpatient, inpatient, emergency department (ED), and prescription medications.
Methods: We performed a quasi-experimental analysis to compare pre-post mandate changes in healthcare utilization and expenditures for children aged 3–18 years in five states with mandates adopted during 2010 relative to five states without mandates throughout the study period. We compared these changes for children with ASD (≥2 outpatient ASD claims ≥7 days apart) and without ASD. We estimated changes separately for fully-insured plans (state-regulated, subject to insurance mandates) and self-insured plans (federally-regulated, not subject to insurance mandates). We used data from MarketScan Research Databases comprised of employer-sponsored insurance claims for 2008-2009 (pre-mandate) and 2011-2012 (post-mandate). We defined encounters for non-medication service types as separate days on which a child had ≥1 claim. Prescription fills were defined as the number of pharmacy claims. Expenditures were accumulated across all claims within a year.Â We computed aggregate counts (encounters or prescription fills) and expenditures for children with ASD and all enrolled children pre-post mandate. Subsequently, we computed the ratios of the aforementioned pre-post mandate ratios (ratios of ratios) of counts and expenditures for children with ASD relative to all enrolled children in mandate compared to non-mandate states, and the percent changes in the final ratios.Â
Results: For fully-insured plans, increases in ED expenditures and visits were 25% and 12% lower, respectively, for children with ASD relative to all children in mandate compared to non-mandate states. For these same groups, increases in inpatient expenditures and admissions were lower by 31% and 21%, and increases in medication expenditures and number of prescriptions were lower by 22% and 12%, respectively. For fully-insured plans, increases in outpatient and behavioral/mental health expenditures and visits were higher by 28% and 7%, respectively, in mandate states, and increases in "other" outpatient expenditures and visits were higher by 10% and 11%. Total expenditures for children with ASD in fully-insured plans in mandate states relative to non-mandate states were unaffected. In contrast, expenditures among children with ASD relative to all children were higher for all service types for self-insured plans in mandate compared to non-mandate states: by 13% for ED, 6% for inpatient, 8% for behavioral, 10% for other outpatient, and 3% for medication expenditures.
Conclusions: These data suggest that state mandates were associated with greater increases in behavioral/mental health visits and smaller increases in ED and inpatient care and filled prescriptions for fully-insured plans only. There was no overall cost increase to the fully-insured plans as a result of state mandates, as lower non-outpatient and medication expenditures fully offset higher expenditures for outpatient care. Further analysis with additional states and more recent mandates is warranted.

Oral Session - 5B
121 - Experiencing Autism as a Family
2:40 PM - 3:30 PM - Yerba Buena 10-14

Session Moderator: Aubyn Stahmer, *Psychiatry and Behavioral Sciences, UC Davis MIND Institute, Sacramento, CA*

2:40 **121.001** An Update on the Interagency Autism Coordinating Committee and the National Institutes of Health

***S. Daniels**, Office of Autism Research Coordination, Rockville, MD*

Background:
In this talk, the Office of Autism Research Coordination (OARC), which coordinates and manages the Interagency Autism Coordinating Committee (IACC), will provide an update on the IACC and its recent activities. The Interagency Autism Coordinating Committee (IACC) is a federal advisory committee established by Congress to coordinate activities concerning autism spectrum disorder (ASD) within the U.S. Department of Health and Human Services (HHS) and among member federal agencies. The committee, composed of 31 federal officials and public stakeholders representing diverse perspectives, provides advice to the Secretary of HHS on issues related to ASD.
Objectives:
The talk will cover background information about the committee and a description of the latest updates to the IACC Strategic Plan, which serves as a guide to federal funders of ASD research and services activities. An update on U.S. federal funding of autism research and recent ASD-related initiatives from the NIH will also be discussed.
Methods: NA
Results: NA
Conclusions: NA

2:52 **121.002** Through Their Eyes: Sisters' Experiences Growing up with a Preverbal Sibling with Autism.

G. Pavlopoulou[1] *and D. Dimitriou*[2]*, (1)Lifespan Learning and Sleep Lab, UCL, Institute of Education, London, UNITED KINGDOM, (2)UCL, Institute of Education, London, United Kingdom*

Background: Â Being the sister of a child with Autism Spectrum Disorder (ASD) can be both a challenging and enriching experience. Siblings' experiences can be complex and often difficult to capture using traditional methods, as they are often habitual and taken for granted. Many everyday activities are likely to be left unquestioned.Â Siblings in early adolescent years growing up with a sibling with ASD have been the subject of little previous research, especially in terms of sisters' experiences.
Objectives: The main goal of the current study was to explore and describe relationships and environmental settings in the life of the typically developing (TD) sisters growing up with a preverbal sibling with ASD.
Methods: The current study takes a phenomenological approach supported by written diaries, photo logs and Photovoice groups along with background testing and 1-1 interviews. Sisters were actively involved by: i) collecting photo data by themselves, ii) determining the content of the data and categorising, and iii) analysing and interpreting the data that consists of their observations, experiences and reflection. This is the first study to use longitudinal Photo-voice methodology in order to give TD sibs an active participatory role, a rare methodological approach in the current field of research. Each interview was audio-recorded and transcribed following the guidelines of interpratative Phenomenological Analysis.
Results: The average age of the sisters was 12.27 years old (SD=1.33) and the average age of the siblings with ASD was 11.6 years old (SD=1.62). Sister-driven content analysis identified eight major categories: birthday parties (22.06%), school assemblies (15%), siblings sharing time together (13.79%), lunch routines (13.79%), sleep routines (11.7%), sensory/self-stimulating behaviours (9.9%), supportive family members (8.14%) and hobbies/talents (4.15%). Four master themes emerged from our analysis: (i) the impact in education; (ii) the uncomfortable position of being different; (iii) need for respite; and (iv) acceptance and advocacy. Sisters' photos are also revealing in terms of the things they chose not to photograph that might have been expected to feature such as their fathers and members of extended family.
Conclusions: Innovative strategies in both research and intervention may shift the balance between vulnerability and resilience. As experts of their own lived experience, sisters shed light on their day-to-day experiences. The findings highlighted the feelings, needs and thoughts the sisters experienced as siblings and carers of children with autism, but also as students and young females with limited networking and support in the community. A strong sense of love and pride of living with autism was expressed throughout the interviews, and this builds into an optimism that can be a crucial part of interventions that help to lift and further develop resilience, wellbeing and a life that is possible while planning for what remains to be difficult. Such information around contemporary and lifecycle issues in the life of siblings is central to the goal of designing proactive empowering interventions by clinicians, communities such as school and other agencies, and by policymakers in relation to both quality improvement and cost containment.

3:04 **121.003** Wellbeing of Parents of Children with Autism Spectrum Disorder: Gender Difference within an Australian Population-Based Sample.

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Background: Research has focused predominately on the experiences of mothers of children with Autism Spectrum Disorders (ASD). Yet, there are studies showing that fathers and mothers experience mental health difficulties and parenting differently[1]. Fathers may experience and express psychological distress differently than mothers; possibly through externalizing disorders (e.g., physical illness, drug and alcohol misuse)[2].
Objectives: To explore differences in experiences of psychological distrss and physical health (i.e., global health, chronic pain, weight, smoking, problematic alcohol consumption) between fathers and mothers of children with an ASD.
Methods: Data were drawn from the *Longitudinal Study of Australian Child* (LSAC)[3]; a large nationally representative study of Australian children and their families. LSAC comprises two cohorts of children, with six waves of data currently available. The present study draws on data from overlapping cohorts when children were aged eight to nine years (Baby-cohort wave 5; Kindergarten-cohort wave 3). Biological or adoptive fathers (n = 156) and mothers (n = 156) of children with an ASD from the same family were identified. Missing data were minimal (<20%) and were addressed by multiple imputation in SPSS 24.0[4], pooled across 20 parallel imputed datasets[5]. A series of bivariate logistic regressions were used to estimate the adjusted risk when controlling for known contextual variables which influence psychological and physical health (e.g., socio-economic position, country of birth, parent age, child gender, ASD severity).
Results: The majority of fathers and mothers were not experiencing elevated levels of psychological distress and reported good physical health (i.e., global health, not experiencing chronic pain, not consuming problematic amounts of alcohol, not smoking). However, the majority of fathers and mothers were categorised within an unhealthy weight category based on the Body Mass Index. Compared to mothers, fathers of children with ASD were at greater risk of: engaging in problematic alcohol consumption, adj. OR = 3.13, 95% CI [1.02-9.61]; being classified as underweight, adj. OR = 7.33, 95% CI [2.99-17.93]; and overweight, adj. OR = 2.29, 95% CI [1.13-4.67] on their Body Mass Index.
Conclusions: The results shed important light on the differences in the psychological and physical health of fathers and mothers raising children with an ASD. Fathers were at greater risk of experiencing physical health problems (i.e., problematic alcohol consumption, unhealthy Body Mass Index) than mothers. Parents of children with an ASD often face many stressors and demands, however they often report that there is not enough support directed to their wellbeing[6]. Continued research and support relating to these difference will improve service capacity to provide quality care to the unique needs of mothers and fathers raising children with ASD.

3:16 **121.004** Compass for Hope: Evaluating the Effectiveness of a Parent Training and Support Program for Children with ASD As a Telehealth Tool

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Background:
The impact of disruptive behaviors in ASD extends to parents and caregivers. Caregivers of children with ASD report higher stress compared to parents of neurotypical children and parents of children from other disability groups (Hayes & Watson, 2013).Research has demonstrated effectiveness of parent focused interventions through rigorous evaluation over the past 30 years (Zisser & Eyberg, 2010). Unfortunately for most families in rural areas, access to interventions that address disruptive behaviors is limited and physical access to services can be a barrier for many families (Bearss et al., 2013; Hodgetts, Zwaigenbaum, & Nicholas, 2015). One solution for access is the use of telehealth technologies to deliver specialized services in real time over a geographical distance (Dudding, 2009; Turner, 2003). COMPASS for Hope (C-HOPE) is an 8-week parent intervention program that was tested via telehealth (TH) and face-to-face (FF) delivery and is adaptable to rural settings. Developed from an existing framework called the Collaborative Model for Promoting Competence and Success (COMPASS; Ruble & Dalrymple, 2002), C-HOPE showed preliminary effectiveness. when comparing pre- and post-ratings of parent stress, parent efficacy, and problem child behaviors with a wait-list control (Rodgers, Ables, Ruble, Kuravackel & Reese, 2015).
Objectives:
The purpose of this study was to establish the efficacy of C-HOPE with families of children with ASD (ages 3 to 12) and its effectiveness as a tele-health tool to support families of children with ASD in underserved communities. Adaptive child behavior (Eyberg Child Behavior Inventory (ECBI; Eyberg & Pincus, 1999), parent self-efficacy (Being a Parent Scale (BPS; Johnston & Mash, 1989), and parenting stress (Parental Stress Index - Third Edition (PSI; Abidin, 1995) were evaluated using a pretest-posttest partially nested design and outcomes were evaluated based on type of delivery format (telehealth vs. face to face).
Methods:
Participants were assigned to one of three conditions: waitlist control (WLC; *n* = 10), C-HOPE delivered via TH (*n* = 10), and C-HOPE delivered FF (*n*= 13). FF was delivered over 4 cohorts and TH was delivered over 3 cohorts.
Results:
Due to the partially nested design and small number of cluster (therapy groups) a multilevel modeling approach for handling partial nesting could not generate stable results; therefore, single-level analyses were conducted correcting for the non-independence using the Type = Complex option in M*plus* to get unbiased estimates of the inferential statistics. Analyses of pretest-posttest differences showed significant improvement in all three outcomes (see Table 1).
Planned comparison analyses of differences on outcomes using pretest scores as a covariate (see Table 2) showed those in the TH condition had significantly lower adjusted child behavior posttest (ECBI) scores than those in the WLC condition (d = 0.99). The combined treatment modality (TH+FF) had significantly better child behavior outcomes (ECBI) than the WLC. condition. Small to moderate effect sizes were obtained on parent efficacy (BPS) and parent stress (PSI).
Conclusions:
C-Hope shows promise as a parent intervention that targets child behavior, parent skill and stress. Moreover, preliminary data suggest that C-Hope can be delivered effectively using telehealth technology.

Oral Session -
122 - INSAR Awards Ceremony
4:00 PM - 5:30 PM - Yerba Buena 8-9

4:00 INSAR Awards Ceremony

Oral Session -
123 - Keynote - Lifetime Achievement Award
5:10 PM - 5:30 PM - Yerba Buena 8-9

5:10 Keynote - Lifetime Achievement Award

Poster Session
124 - Adult Outcome: Medical, Cognitive, Behavioral
5:30 PM - 7:00 PM - Golden Gate Ballroom

1 **124.001** Adults with Autism Spectrum Disorder and the Criminal Justice System: An Investigation of Prevalence of Offending, Risk Factors and Gender Differences.

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Background: The behavioural and cognitive difficulties of some adults with autism spectrum disorder (ASD) may increase their risk of contact with the Criminal Justice System (CJS) either as offenders or victims of crime. There has been limited investigation of ASD and offending. However, available evidence is mixed; some studies report an increased prevalence of ASD in offending populations, an increased risk of committing specific crimes (assault and arson) or that people with ASD are no more likely to commit offences than non-ASD people.
Objectives: To compare prevalence of offending between adults with ASD and adults without ASD and to investigate between-group differences in types of offences. Further, to investigate gender differences and identify potential risk factors for offending in adults with ASD.
Methods: A retrospective review was completed of the medical records of 1275 adults who attended the Behavioural Genetics Clinic Adult Autism Service, the Maudsley Hospital, for assessment of possible ASD between April 2003 and January 2016. Participants ranged in age from 17 – 75 years of age (M = 32 years, SD = 12); 960 males and 305 females. 880 adults were diagnosed with ASD (660 males, 200 females) and 395 adults were not diagnosed with ASD (non-ASD group; 290 males, 105 females). The presence or absence of ASD and psychiatric co-morbidity was determined by consultant led multidisciplinary expert consensus, according to ICD-10 research criteria and confirmed with either an ADI-R and/or ADOS where possible. The presence of offending behaviour and type of offence (violence, sexual crime, arson, criminal damage, stalking/harassment, theft/burglary, substance misuse and other offences) was identified from medical reports. Forensic history was defined as contact with the CJS; this could include contact with the CJS both as offenders or victims of crime. Qualitative data from medical reports was transformed into nominal data in SPSS and between-group comparisons were made using chi-square tests.
Results: Non-ASD adults were significantly more likely to have a forensic history than adults with ASD (32% vs. 26%; χ^2=5.27, *p*=.02; figure 1). Non-ASD adults were more likely to have committed theft/burglary (9% vs. 5%; χ^2=6.05, *p*=.01) and substance offences (6% vs. 3%; χ^2=6.19, *p*=.01) than adults with ASD. Regarding risk factors, adults with ASD and comorbid ADHD were significantly more likely to have a forensic history than adults with ASD who did not have ADHD (32% vs. 24%; χ^2=4.16, *p*=.04). Adult males with ASD were significantly more likely to have a forensic history than adult females with ASD (30% vs. 13%; χ^2=23.56, *p*<.001).
Conclusions: Adults with ASD were less likely to offend and no more likely to commit any offence than non-ASD adults referred for clinical assessment of ASD. However, 26% of adults with ASD had a forensic history (either as perpetrators or victims of crime). Comorbid ADHD and male gender were risk factors for offending in adults with ASD. Health services research for adults with ASD is warranted, including liaison between CJS and mental health services to reduce the risk of adults with ASD becoming offenders or victims of crime.

2 **124.002** Age-Related Changes in Effortful Processing in Adults with ASD

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Background: Little is known about age-related changes in cognitive functioning in adults with ASD. However, three previous studies of cognitive aging in ASD show similar or reduced age-related changes in cognitive functioning compared to adults with typical development (Geurts & Vissers, 2012; Lever & Geurts 2015; Lever et al., 2015).
Objectives: The primary objective of this study was to further examine age-related effects on cognition using measures sensitive to age-related decline while controlling for moderating variables (e.g., IQ, baseline motor abilities) that might obscure the relationship between age and cognitive functioning.
Methods: Twenty-nine adults with ASD and 30 adults with typical development were recruited for this study.Â Participants were group-matched on age (range: 30 – 67), gender, and IQ (range: 92-130), all *p*-values > .42. ASD diagnoses were confirmed via the self-report adult version of the SRS-2 and the ADOS-2. Participants completed several measures of cognitive functioning including measures of processing speed (Trail Making Test A), explicit memory (RAVLT Free Recall), executive functioning (Trail Making Test B, MoCA), and category learning (Woodcock-Johnson Concept Formation subtest).
Results: To assess diagnostic and age-related effects on measures of cognitive functioning a multivariate regression was conducted including Z-scores taken from standardized assessments of explicit memory, concept formation, executive functioning, and processing speed as dependent variables. Results revealed significant main effects of IQ [Wilks' λ = .467, $F(10, 43) = 4.91$, $p < .001$, $\eta_p^2 = .53$], age [Wilks' λ = .567, $F(7, 46) = 5.02$, $p < .01$], and diagnosis [Wilks' λ = .532, $F(7, 46) = 5.78$, $p = .01$, $\eta_p^2 = .47$], were qualified by a significant age by diagnosis interaction [Wilks' λ = .710, $F(7, 46) = 2.70$, $p = .02$, $\eta_p^2 = .29$]. Results suggest age may have a larger impact on cognitive functioning in older adults with ASD than older adults with typical development. The significant age by diagnosis interaction was primarily driven by performance on three measures thought to reflect components of working memory/executive function (e.g., Trail Making Test B, MoCA, Free Recall), Wilks' λ = .800, $F(3, 53) = 4.34$, $p < .01$, $\eta_p^2 = .20$.
Conclusions: Â Closer inspection of measures of cognitive functioning revealed greater age-related decline in ASD was not present across all cognitive domains, instead evidence points to accelerated cognitive aging in adults with ASD on tasks related to working memory. To the best of our knowledge, these findings are the first to document specific cognitive domains that are more disrupted by the aging process in adults with ASD compared to adults with typical development. Although findings are somewhat in contrast to previous studies of aging in ASD, which may be due to differences in sample characteristics (i.e., inclusion of individuals diagnosed in childhood) or analytic methods (i.e., controlling for IQ), they provide insight for the development of cognitive training interventions targeting specific cognitive difficulties faced by older adults with ASD. Yet, given that this study used a cross-sectional design, it is important that future studies replicated findings with a longitudinal sample.

3 **124.003** An Assessment of the Writing Skills and Writing Self-Efficacy of Autistic College Students and Their Mentors

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Background:
Discrepancies between high cognitive and variable writing skills have been documented since the earliest accounts of autism (Asperger, 1991). Although writing skills are essential in college, the writing skills and self-efficacy of autistic college students have received almost no empirical attention (Gerstle & Walsh, 2010). Jurecic (2007) described difficulties one autistic college student faced writing for an audience and speculated that they might be attributable to Theory of Mind (ToM) challenges. The few studies that have examined writing skills among autistic children/adolescents suggest that they produce fewer written words and have more variable writing skills but do not differ overall in standardized writing scores relative to non-autistic youth (Griswold et al., 2002; Myles et al., 2003).
Objectives:
1) To compare writing skills, self-efficacy, and ToM among autistic and non-autistic college students.
2) To examine associations between measures among autistic students.
Methods:
Autistic college students in a mentorship program (n = 19) and non-autistic mentors (n = 6) completed pre-test assessments: the Social Responsiveness Scale-2 (SRS-2); Woodcock-Johnson Word Comprehension; Reading the Mind in the Eyes (RMIE), a nonverbal ToM measure; a writing self-efficacy measure (MacArthur et al., 2016); the Test of Nonverbal Intelligence (TONI); and a writing activity, wherein they were asked to share something interesting they had learned recently.
Results:
Autistic students reported heightened autistic traits and belief in writing conventions (a subscale of the self-efficacy scale; e.g., “Good writers don’t make errors in grammar”), wrote fewer words and sentences, and had lower RMIE scores (ps< .05) relative to mentors (see Table 1). Word comprehension, NVIQ, nonverbal ToM, other subscales of the self-efficacy measure (self-efficacy, goal-oriented avoidance, performance and mastery, beliefs about content and writing affect), errors, examples and perspective taking in writing did not differ.
Among autistic students, higher SRS-2 scores were positively associated with word comprehension and negatively correlated with goal-oriented performance (ps< .03). Nonverbal intelligence was associated with nonverbal ToM; word comprehension was associated with RMIE (ps< .02). No associations between writing volume, writing self-efficacy subscales, or ToM measures were observed.
Conclusions:
Replicating findings with autistic children/adolescents, autistic college students produced shorter texts than non-autistic mentors despite no group differences in NVIQ and word comprehension. This is consistent with our observations during mentorship; a number of autistic students encounter pronounced difficulty initiating and elaborating on their ideas through writing despite often high grammatical skills. Heightened belief in writing conventions (perfectionistic/rigid beliefs about writing) may contribute to these difficulties. However, no associations between writing self-efficacy subscales and writing performance were observed. The new writing self-efficacy measure used in this study had not previously been used with autistic students; it was highly reliable in this sample (α= .92). AutisticÂ students’ provided heterogeneous accounts of their writing self-efficacy, warranting further examinations of predictors of writing self-efficacy in a broader sample. Consistent with evidence that associations between ToM and spoken narrative skills among autistic children are apparent only for children with below average IQs (Capps et al., 2000; Losh & Capps, 2003), ToM was unrelated to writing skills among autistic students with average IQs.

4 **124.004** An Examination of Community Participation in Adults Diagnosed with ASD

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Background: Â Research suggests participation in the community greatly decrease as an individual with ASD transitions into adulthood. This may be, in part, due the many barriers adults with ASD face. These barriers include lack of resources, limited opportunity, and limited self-determination or self-efficacy skills. Self-determination, in particular, is important when considering an individual’s community integration as it can inform treatment planning and can provide more meaningful opportunities for community participation. Providing the individual with opportunities to determine for themselves important activities may increase self-efficacy and meaningful community participation for adults with ASD.
Objectives: Â The current study examined differences in community participation in adults diagnosed with an ASD and neurotypical (NT) individuals. The study also obtained a subjective measure of the importance of the activities within the community (i.e., grocery shopping, attending a social gathering). Implications of independent community engagement will be explored. Additionally, the paper presentation will discuss the role and importance of self-determination in community participation for treatment planning.
Methods: Sixty-one adults, recruited from larger research projects, completed the Temple University Community Participation (TUCP) measure. Of the sixty-one individuals, 33 adults were diagnosed with an ASD. Symptoms of an ASD were confirmed by an informant report using the Social Responsiveness Scale- Second Edition (SRS-2; *M* = 66.50, SD = 10.32). Individuals in the study completed the TUCP measure, a measure of community engagement across various domains, to assess frequency of community participation as well as a subjective measure of importance of these activities to the individual.
Results: An independent samples t-test was conducted to compare self-reported measures of community participation. Individuals with ASD reported significantly fewer community participation days (M = 36.73, SD = 31.73) than NT individuals (M = 89.18, SD = 29.43) $t(59) = -.6.65$, p = 0.000. Significant differences were also observed in the number of activities that individuals with ASD (M = 6.48, SD = 4.09) engaged in compared to NT individuals (M = 12.50, SD = 3.04), $t(59) = -.6.42$, p = 0.000. When asked to rate the importance of activities, significant differences were also observed with individuals with ASD reporting fewer important activities (M = 11.97, SD = 5.81) than NT individuals (M = 15.32, SD = 3.50) $t(59) = -.2.67$, p = 0.01.
Conclusions: Results of the analyses supported the hypotheses that individuals with ASD report less independent engagement in the community and identified fewer important activities when compared to individuals without ASD. The results suggest a continued need to support adults in independent community engagement for a successful transition as well as integration of the individual’s self-identified important and meaningful activities when encouraging community inclusion. Results of the current study raise important questions regarding implicit biases that caregivers and treatment providers may have regarding the amount and type of participation that is sufficient for individuals with ASD. In addition, the data suggests that there may also be other factors impeding the individual’s ability to participate in the community, including low self-efficacy, social avoidance, or limited opportunities or access to the community.

5 **124.005** Association Between Affective Symptoms and School Bullying Experiences in Adults with Autism Spectrum Disorders

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Background: Affective symptoms such as anxiety and depression are common in individuals with autism spectrum disorders (ASDs), as is a history of being bullied. Though it stands to reason that bullying experiences could contribute to affective symptomatology in adults with ASDs, it is unclear which bullying variables are most strongly associated with affective symptomatology.
Objectives: To describe affective symptomatology endorsed by adults with autism spectrum disorders and determine what relationship those symptoms have to bullying experiences.
Methods: A survey evaluating current affective symptomatology (depression, anxiety and anger) as well as details about school bullying experiences was completed anonymously by 48 adults (36 male) with ASDs. 58.4% had attended at least some college. Subjects were recruited at local autism community meetings or were mailed the instrument after expressing interest in participation. The latter subjects were identified from a database maintained by the Arizona State University Autism/Asperger's Research Program. Comparison between the groups was conducted using the non-parametric Kruskal Wallis test for population mean shift between the groups for continuous variables. The Pearson Chi-Squared and the Fisher's exact tests were used to test for group proportion differences for categorical variables.
Results: Â The majority of respondents reported depression (85.1%), anxiety (87.2%) and anger (68.8%). Depression severity reported by respondents was: "Not at all" (14.9%), "A little bit" (27.7%), "Somewhat" (25.5%), "Quite a bit" (17.0%), and "Very much" (14.9%). Anxiety severity reported was: "Not at all" (12.8%), "A little bit" (23.4%), "Somewhat" (23.4%), "Quite a bit" (25.5%), and "Very much" (14.9%).Â Anger severity reported was: "Not at all" (31.3%), "A little bit" (31.3%), "Somewhat" (12.5%), "Quite a bit" (20.8%), and "Very much" (4.2%). Of those reporting depression or anxiety, 51.2% were not receiving treatment. Only 6 respondents reported no history of bullying. Bullying experiences during college were associated with more severe depression (p=.0485), while bullying during preschool/kindergarten (p=.0323) and high school (p=.0261) were associated with *any* depression. Bullying experiences during elementary school were associated with more severe anxiety (p=.0350) as well as *any* anxiety (p=.0037). Bullying experiences during graduate school were associated with more severe anger (p=.0404). Prolonged bullying during elementary school was associated with *any* anger (p=.0490). Those respondents experiencing the greatest bullying frequency across *all* school levels were more likely to endorse depression (p=.0276) and anxiety (p=.0194). Cyber bullying in school settings was associated with more severe depression (p=.0042), anxiety (p=.0467), and anger (p=.0219).
Conclusions: Bullying experiences reported by individuals with ASDs appear common across multiple school settings and are associated with a significant burden of affective symptomatology in adulthood. The school level at which bullying occurred and variables describing the type and intensity of bullying experiences may predict the types of affective symptomatology impacting adults with ASDs. Such symptomatology appears undertreated.

6 **124.006** Augmenting Primary Health Care for Adolescents and Adults on the Autism Spectrum with Intellectual Disability

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Background: Adults on the autism spectrum with intellectual disability experience unique health-related needs, difficulties accessing adequate health care and exhibit poorer physical and mental health outcomes in comparison to the general population. The Comprehensive Health assessment Program (CHAP) was developed by Prof Nick Lennox for adults with intellectual disability to improve access to healthcare, enhance communication between adults with intellectual disability, their families/caregivers and their general practitioner (GP), improve integration of healthcare and educate all those involved in the process. Three randomised controlled trials have shown this process significantly increases health screening and promotion and the identification of new disease in adults and adolescents with intellectual disability.
Objectives: The objective of this project was to develop a comprehensive health assessment program for adults on the spectrum with intellectual disability.
Methods: This project adapted the CHAP for adults and adolescents on the autism spectrum. It was informed by a review of the literature and feedback from an advisory group comprised of adults on the spectrum and their caregivers, health professionals and researchers working with adults and adolescents on the spectrum with intellectual disability.
Results: The review of the literature identified additional items and resources to be included in the adapted CHAP. This included the inclusion of a section about the sensory experiences of the person on the spectrum, information about their diagnosis of autism, additional questions about their gastrointestinal health, unusual eating patterns and additional information about strategies for working with adults on the spectrum with intellectual disability for the GP and health practice nurse.
The CHAP was adapted to reflect the inclusion of these items and resources, and then provided to the advisory group for feedback. These suggestions resulted in a number of changes, most noticeably; the change of language to first person language, the wording of questions regarding sexuality and human relations to illustrate that individuals may be transgender or identify with another gender and re-wording the mental health questions to include a question about self-harm. Feedback from advisory group members suggests the adaptation is appropriate and feasible for use with adults and adolescents on the spectrum with intellectual disability.
Conclusions: The adapted CHAP will be trialled with Australian adults and adolescents on the autism spectrum with intellectual disability. Feedback will be sought from the individual, their support person/s and health professional. This health assessment tool has the potential to improve health outcomes for adults and adolescents on the spectrum with intellectual disability.

7 **124.007** Autism Spectrum Conditions in People Who Died By Suicide in the UK.

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Background: There is a significantly increased risk of suicidal ideation, suicidal behaviours (Cassidy et al. 2014) and death by suicide (Hirvikoski et al. 2015) in people with Autism Spectrum Conditions (ASC) compared to the general population. However, previous research has focused on prevalence of suicidality in clinic-based ASC samples. No research has yet explored suicide in general population samples, or compared the characteristics of suicide in those with and without ASC. This is key to understanding and thus preventing suicide among those with ASC.
Objectives: 1) To establish whether ASC diagnoses are over-represented among people who died by suicide in the UK; and 2) To compare the characteristics of suicide in those with and without ASC.
Methods: The first wave of data collection from a UK psychological autopsy study is presented. Coroners' inquest records for the period 2014-2016, ruling a suicide or open verdict, were requested from two UK cities. These records were scrutinised for evidence of ASC diagnoses; *Definite Diagnosis* (where the individual had a formal diagnosis of an ASC); *Strong Evidence* (where two independent judges agreed that the individual met all the criteria for ASC but had no formal diagnosis); *Probable Diagnosis* (where the two independent judges agree there are many signs, but there are gaps in the evidence); and *No Evidence* (where the person had no clear signs of ASC, even if other diagnoses were present and which were noted). Characteristics of those who died by suicide were also noted (gender, age at death, previous suicide attempts, suicidal ideation, mental and physical health conditions, environmental stressors, recent access to services).
Results: 219 coroners inquest records were assessed, 153 of which were ruled a likely suicide according to ICD-10 criteria. Of these, 11.76% had evidence of ASC, significantly higher than the rate of ASC in the general population in the UK (1%); 0.7% were classed as *Definite Diagnosis*; 1.3% as *Strong Evidence*; and 9.8% as *Probable Diagnosis*. There were no significant differences between the groups in terms of age, gender, number of physical or mental health conditions, presence of environmental stressors or previous suicidal ideation/attempts.
Conclusions: A significant minority of cases of death by suicide in the UK general population show evidence of the person having previously undiagnosed ASC. Preliminary analysis from the first wave of data collection so far suggests that individuals with and without evidence of ASC diagnosis did not significantly differ in terms of their broad characteristics (age at death, gender, number of physical or mental health conditions, presence of environmental stressors, likelihood of experiencing suicidal ideation or attempts, and recent access to services). Considering that many adults remain undiagnosed with ASC (Lai and Baron-Cohen, 2015), it is important for clinicians to be aware of increased suicide risk in ASC, and where ASC diagnosis is suspected, consider screening for suicidal thoughts and behaviours. These results will inform training for medical and allied professionals in an effort to improve suicide prevention, and highlight ASC as a particularly vulnerable group in the population.

8 **124.008** Autistic Traits and Suicidal Thoughts, Plans and Self-Harm in Late Adolescence: Population Based Cohort Study

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Background:
The potential role of suicide as a contributor towards the excess premature mortality in people with autism has been highlighted recently. However there is relatively little understanding about which features of autism may lead to suicidal thoughts and behaviours and whether there are any potentially modifiable mediators. Existing research is largely limited to case reports or small clinical samples and there is a need for longitudinal, population based studies to provide further insights into the burden and pathways of suicidal thoughts and behaviours in autism.
Objectives:
Study objectives were two-fold: i) to examine the association of trait measures of autism with suicidal and self-harm behaviour at age 16 years; ii) to examine whether any associations could be explained by depression in early adolescence at age 12 years.
Methods:
Participants were 5,034 members of the Avon Longitudinal Study of Parents and Children (ALSPAC), a UK population-based birth cohort who completed a postal questionnaire on self-harm with and without suicidal intent, as well as suicidal thoughts and plans at age 16 years. Four autistic trait measures were analysed. These included the coherence subscale of the Children's Communication Checklist (assessed at 9 years), the Social and Communication Disorders Checklist (measured at 8 years), a repetitive behaviour measure (assessed at 6 years), and the sociability temperament subscale of the Emotionality, Activity and Sociability scale (measured at 3 years). These measures were dichotomised, with approximately 10% defined as the autism 'risk' group. Multinomial and modified poisson regression analyses were used to examine the associations between autistic trait measures and suicidal and self-harm behaviour at age 16 years. Structural equation modelling (SEM) was used to examine whether depression in early adolescence, as measured by the moods and feelings questionnaire (SMFQ) at 12 years, may explain this association. Analyses were adjusted for a range of child, parental and familial confounding factors.
Results:
Impaired social cognition at age 8 years was associated with increased risk of suicidal (adjusted OR=2.14, 95% CI 1.28 to 3.58, p=0.004), but not non-suicidal self-harm (adjusted OR=1.02, 95% CI 0.62 to 1.67, p=0.943) at age 16 years. Impaired social cognition was also associated with suicidal thoughts (adjusted OR=1.43, 95% CI 1.06 to 1.92, p=0.019) and plans (adjusted OR=1.95, 95% CI 1.09 to 3.48, p=0.024). There was no evidence for an association between the other autistic traits and self-harm with or without suicidal intent, suicidal thoughts and/or plans. Approximately 40% of the total estimated association between impaired social cognition and self-harm with suicidal intent was explained by depression in early adolescence.
Conclusions:
Impairments in social communication were strongly associated with suicidal thoughts, plans and behaviours at age 16 years. A substantial proportion of this effect was explained by depressive symptoms. These findings suggest that the social impairments associated with autism may be important in relation to suicidality, and that identification and treatment of depression may have the potential for preventative action.

9 **124.009** Barriers and Enablers to Success at Work: The Dandelion Program

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Background: Individuals with Autism Spectrum Disorder (ASD) are overrepresented when it comes to both unemployment and underemployment (Shattuck et al., 2012). Organizations can potentially improve employment opportunities for individuals with diverse needs by making reasonable adjustments and creating supportive workplace environments (Cavanagh et al., 2016; Yang & Konrad, 2011). However, there has been sparse research to date specifically aimed at identifying the factors associated with success at work from both the perspectives of the individual, and those who work with or support them.
Objectives: Our aim was to gain a better understanding of the factors that promote workplace success, the barriers to success, and program-related outcomes, for individuals with ASD participating in the Dandelion Program. The program is a three-year traineeship for adults with ASD developed by Hewlett Packard Enterprise (HPE), Australia, which provides an alternate pathway into employment in the information technology sector. Participants work within the Australian Federal Government. The program provides additional workplace supports to accommodate participants' diverse needs.
Methods: We used qualitative methodology (focus groups) to identify barriers and enablers to success at work in the context of the Dandelion Program. Participants comprised 28 adults: nine adults with ASD (89% male; M_{age}= 23.97 years, SD_{age}= 3.00) who were employed as software testers within the Dandelion Program; six of their family members (33% male; M_{age}= 43.92 years, SD_{age}= 13.89); seven support staff (29% male; M_{age}= 36.83 years, SD_{age}= 8.52); and six coworkers (67% male; M_{age}= 42.21 years, SD_{age}= 6.46). Focus groups were recorded, transcribed and coded. We adopted an inductive approach to content analysis (Thomas, 2006) conforming to COREQ guidelines (Tong, Sainsbury, & Craig, 2007) to analyze the data. From this process we developed a framework consisting of three main themes and 10 subthemes.
Results: The main themes identified were barriers, enablers, and general work outcomes. Overlapping themes were identified between all participant groups; however there were also subtle differences that emerged between them. For example, family members noted improved relationships at home that were not identified by the individuals with ASD themselves. Organisational support, advice from co-workers, supportive leadership, environmental modifications, and, in particular, the presence of an autism consultant, were identified as factors that facilitated success at work.Â Barriers to success included task related difficulties, individual factors, social difficulties and distractions, not managing work related stress, and being blunt ('too honest'). Overall, the program was positively appraised by participants. Positive outcomes of the program included trainees having a sense of purpose, financial and personal independence, and improved social relationships.
Conclusions: One of the most significant outcomes of this study was the identification of the positive attitudes of co-workers who worked closely with the trainees. The findings from this research provide evidence for the feasibility of implementing employment programs to support individuals with ASD, and identification of factors that promote, and also impede, workplace success, from the perspectives of the individuals involved.

10 **124.010** Building Employer Capacity to Support Meaningful Vocation for People with ASD: A Grounded Theory Study of Multi-Stakeholder Perspectives

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Background: Little is known about best practices for helping employers support individuals with autism spectrum disorder (ASD) in attaining and retaining meaningful employment. An understanding and evaluation of specific employment and employer practices that foster employment success (i.e., job access, retention and advancement), and conversely existing gaps that require further development, is needed. As such, there is an urgent need for an evidence-informed theoretical base upon which salient variables (processes and outcomes) can be identified and examined for further evaluation within observational, interventional and longitudinal studies. This field is largely impeded until such a theoretical base is developed, and salient components of employer need to support meaningful employment for individuals with ASD are available.
Objectives: This research systematically explored strategies for building employer capacity to support meaningful employment opportunity for individuals with ASD.
Methods: Given the need for theoretical understanding to inform and advance vocational opportunity for individuals with ASD, a grounded theory design was used. Grounded theory is well established for the investigation of complex, multi-faceted human experiential phenomena, offering a theoretically rich understanding of processes and perceived outcomes. Purposeful and theoretical sampling was used to recruit participants across two Canadian provinces, Ontario and Alberta. Data collection to date has involved individual and group interviews with adults with ASD (N=25), their caregivers (N=12), employment supports (N=32), and employers (N=5). Recruitment, data collection and analysis is ongoing until data saturation is reached. We anticipate closing recruitment by the end of 2016. In line with grounded theory methods, data analysis is an iterative process. Therefore, verbatim (identifiers removed) transcripts and associated field notes are subjected to qualitative data analysis as they are completed. Data management and analysis are supported by N-Vivo11 software.
Results: Preliminary data analysis reveals five emergent themes related to building employer capacity to support vocational development for adults with ASD: (1) Accommodation; (2) Education and understanding disability; (3) Employment supports as vital; (4) Equal treatment and provision of equal opportunity for people with ASD in the workforce; and (5) Perception of visible versus invisible disability in the workforce.
Conclusions: This research is novel is its focus on building employer, rather than employee, capacity to support meaningful employment for individuals with ASD. Identified gaps and potential solutions, from the perspectives of multiple stakeholder groups, will be discussed.

11 **124.011** Building Employers' Capacity to Support Vocational Opportunities for Adults with ASD: A Synthesis Review of Practices, Strategies and Perceptions

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Background: Â There is a significant body of literature on the value of supported employment and its significance for employers, and perceived potential challenges in employing individuals with autism spectrum disorder (ASD). Despite examples of successful and supportive interventions and vocational experiences for adults with ASD, substantial gaps remain. For example, the existing literature has largely focused on employment preparation and attainment, but has neglected job maintenance, and strategies to support employers' capacity development (Nicholas, Attridge, Zwaigenbaum & Clarke, 2014). The role and practices of employers seem central to job access and retention for people with ASD. To our knowledge, there has been no knowledge synthesis related to building employer capacity; however, such information has the potential to advance the field by identifying both existing capacity and knowledge gaps in this area.
Objectives: Â The purpose of this synthesis review was to identify studies focusing on services and supports that foster employers' capacity to support employment for adults with ASD.
Methods: Â A literature search was conducted with the assistance of a research librarian to identify studies addressing services and supports reported to build employer capacity to support vocational opportunities for adults with ASD. The search was conducted in EBSCO UAlberta Library search, which automatically includes more than 50 electronic bibliographic databases. Some of the major databases include are: MEDLINE, EMBASE, CINAHLplus, PsycINFO, Family Studies Abstracts, Web of Science, Scopus, Academic OneFile, Canadian Points of View Reference Centre, Business Source Complete, Canadian Reference Centre, SocINDEX. Key terms such as (employer* or company or companies or organization* or supervisor*) AND (hire or hiring or employ* or "vocational opportunit*") AND (autis* or ASD) were used. Two reviewers independently screened for inclusion, extracted data, and assessed study quality. Inclusion criteria were: (1) peer-reviewed literature, (2) English-language, (3) individuals with DD, and (4) employers and colleagues' perspectives.
Results: Fourteen studies met inclusion criteria and were included in the review. This synthesis review reveals several key findings. Involvement of support workers was conveyed as a core strategy for building employer capacity to support employees with ASD. In addition, disability awareness training, education, and acknowledgment of the benefits associated with of employing individuals with ASD were identified as supports. Employer concerns about required accommodation for employees with ASD were also identified. Collectively, these findings highlighted evidence gaps and future research directions in the field of building employer capacity to ultimately improve vocational outcomes for individuals with ASD.
Conclusions: There is a significant body of literature on the value of supported employment and its significance for employers, as well as a few studies addressing perceived challenges associated with employing individuals with ASD. Findings from this synthesis review notably indicate a lack of research focused on understanding employer's perspectives of what is vital to develop their capacity to support vocational opportunities for adults with ASD.

12 **124.012** Characteristics and Health Conditions of Publically-Insured Autistic Young Adults

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Background:
As increasing numbers of autistic adolescents age into adulthood, a primary concern is whether adult healthcare needs are recognized and treated appropriately (Nicolaidis et al., 2012). Croen et al. (2015) found that adults with ASD were more likely to have psychiatric, immune, cardiovascular, metabolic, endocrine, neurologic, gastrointestinal, and other conditions than same-age adults without ASD. Public insurers may be used by adults with autism to meet their healthcare needs. Although Medicaid is the most well-known public payer, persons younger than 65 can obtain access to Medicare. Young adults with autism may be eligible for Medicare due to eligibility through SSDI or old-age and survivors benefits. Due to the increasing prevalence and public health burden of increasing care needs of aging adults with ASD, it is imperative to identify utilization among a publically insured sample of adults with ASD.
Objectives:
This presentation will describe differences in comorbid conditions among young adult Medicare beneficiaries aged 18-25 years with ASD and no intellectual disability (ASD-only), as compared to beneficiaries with ASD and ID (ASD+ID) and adults with ID only. Subgroup analyses by race/ethnicity and gender will be presented.
Methods:
We conducted a retrospective analysis of existing national Centers for Medicare and Medicaid (CMS) claims Limited Data Sets (LDS) for 2008-2010. Claims associated with beneficiaries with ICD-9 codes of 299.xx were flagged as ASD, and 317.xx, 318.xx or 319.xx represented beneficiaries with ID. Analyses were conducted on all extracted claim files for eligible beneficiaries (inpatient, outpatient, home health, hospice care, skilled nursing facility services and professional services). We used the Agency for Healthcare Research and Quality H-CUP Clinical Classification Software (CCS)® to create condition flags from each claim (AHRQ, 2015). CCS uses standard ICD-9-CM codes to flag claims. Additional confirmation of CCS condition flags with ICD-9 code classification is underway. Chi-square statistics were used to identify differences in rate of occurrence of each condition between groups. Bonferroni correction for multiple comparisons resulted in differences between groups with *p* less than .003 as considered statistically significant.
Results:
Due to space, only 2008 results are described below; presentation data will contain all three years. Table 1 displays rates and 95%CI for specific conditions between the three groups. Seizure disorder occurred more frequently among young adults with ASD+ID than the other two groups; this difference was observed in 2009 and 2010 claims. Parkinson's disease was more prevalent among adults with ASD+ID than those with ID-only in 2008; this difference was not observed in other claim years. Adults with ID-only were significantly more likely than adults with ASD to experience 10 of the 17 conditions examined.
Conclusions:
Observed rates of psychiatric and medical conditions were significantly greater among young adults with ID than those with ASD for most conditions. Findings of greater rates of seizure disorder mirror those of other research. Additional analyses are ongoing to adjust for demographic characteristics that differ between groups. Practitioners, researchers and policymakers should attend to the impact that developmental disabilities, generally, have on health and health maintenance.

13 **124.013** Characteristics of Adult Females with Autism Spectrum Disorders in a Large Multicultural Sample

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Background:
Female Autism has been generating increasing efforts in research still most adult females studies of ASD has targeted neuro anatomical differences or specific cognitive profiles, but little efforts have been made to understand and describe the characteristics of adult women with ASD in depth and in large cross-cultural Spanish speaking sample.
Objectives:
The aim of the study was to design an online questionnaire and analyze in depth a large sample of woman with ASD in diagnostic routes, comorbidity, socialization strategies, special interests, sensory profile, developmental history, self-regulation and personal autonomy.
Methods:
After a period of exhaustive literature revision, an online Spanish questionnaire was designed and completed voluntarily by 265 woman of whom 188 had a formal diagnosis from a reliable and traceable source and were older than 18 years old. Statistical data was analyzed with SPSS for descriptive results n=188.
Results:
Participants were from 22 countries, most of them from Spain, México, Argentina, Venezuela and Chile aged from 18 to 73. The average delay for diagnosis was 5 years. Half of the women were mothers. Previous diagnosis and comorbidity were similar depression (40%, 34%) anxiety (36% 46%) eating disorders (11%, 20%) among others. Most women reported to have one or two friends, and many used socializing strategies as observation (63%) social scripts planning (58%), imitation, back analysis, (47%) and analysis of films and movies (40%). Memory and vocabulary were perceived as strengths by a large part of the sample (70%).Most woman reported social related hiper sensitivity (crowded places, physical contact, and sounds 65-70%). Anger behavior were explosive in many cases (57%) or blockage (54%).Interest in infancy were perceived as different from peers (70%) but more conventional in adulthood with striking interest in reading (63%) human behavior (35%) and psychology (39%) In their development they reported to had challenges in group play as girls (61%) and public speaking (60%).
Conclusions:
Though many limitations, for the size and depth of the study results has many implications. Diagnosis and identification of woman with autism is still late and a challenge in many countries, women are first treated for their comorbidities. Most of diagnosis routes resulted in comorbid conditions and more effort should be done for screening and diagnosis instruments design to clinical judgement and training.
Very few women did not have friends, and that support literature that woman might have better socials skills than males, their accommodation is less intuitive and more cognitive than neurotipicals, and indicate that camouflage strategies from literature do exist, however they might mask symptoms. In addition, emotional regulation is not always successful as might be polarized. Results on development history support the subtle presentation hypothesis during childhood, and more evidence during adolescence. In depth analysis of results might be helpful for identification and program design, an urgent need to guarantee appropriate diagnosis and treatment across different community and countries.

14 **124.014** Childhood Theory of Mind and Cognitive Flexibility and Early Developmental Change in Planning Skills Predict Later Behavioural Outcomes in Autistic Adolescents: A 12-Year Prospective Study.

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Background: Longitudinal studies of autistic people show that the behavioural features of autism generally endure into adulthood. It remains unclear, however, whether individual differences in early cognitive skills are longitudinally related to individual differences in specific behavioural outcomes.
Objectives: Here, we test the predictive utility of measures of childhood theory of mind (ToM) and executive function (EF) as well as the role of early developmental change in these cognitive constructs on emerging autistic symptomatology and adaptive behaviour in a cohort of autistic youth over a 12-year period.
Methods: Twenty-six cognitively able young autistic people (2 female) took part in a prospective longitudinal study. Participants were assessed on two key components of EF (planning and set shifting) and on a battery of ToM tasks (1st- and 2nd-order false belief) at Time 1 (*M*=5 years; 7 months, *SD*=11 months) and again at Time 2, 3 years later (*M*= 8 years; 4 months, *SD*= 12 months). We also measured participants' core autistic features (as indexed by the ADOS-2) and adaptive behaviour (as indexed by the Vineland-II) at Time 3, 9 years later (*M*=17 years; 10 months, *SD*= 14 months). Regression analyses were conducted to test whether early levels of cognitive skills (Time 1 ToM and EF) and the rates of developmental change in ToM and EF (between Time 1 and Time 2) could explain unique variance in (1) autism symptomatology and (2) adaptive behaviour in late adolescence.
Results: With regard to predicting autistic symptomatology, individual differences in Time 1 age, verbal and non-verbal ability failed to significantly predict variance in adolescents' ADOS-2 scores, $F(3,18)=.02$, $p=.99$, $R^2=.003$. The addition of Time 1 set-shifting ability and ToM significantly improved the fit of the model, $F(5,16)=5.26$, $p=.004$, $R^2=.50$. Finally, developmental change in planning ability between Time 1 and 2 explained a further 18% of unique variance in core autistic features, $F(6,15)=5.26$, $p=.004$, $R^2=.68$. With regard to adaptive behaviour, Time 1 age, verbal and non-verbal ability failed to significantly predict variance in adolescents' Vineland-II scores, $F(3,18)=1.96$, $p=.16$, $R^2=.25$. When we entered the early cognitive variables into the model, only Time 1 set-shifting ability significantly improved model fit, explaining an additional 20% of the variance in adolescents' adaptive behaviour, $F(4,17)=3.43$, $p=.03$, $R^2=.45$.
Conclusions: We show for the first time that both ToM and EF measured in childhood – and critically, early developmental changes in EF – predict specific aspects of autistic adolescents' behavioural outcomes 12 years later. These findings suggest that early-emerging cognitive atypicalities could cause behavioural disruptions that persist into early adulthood, possibly even persisting beyond the cognitive atypicalities themselves. The predictive power of these cognitive variables both adds weight to the veracity of these models as explanatory tools in autism research and underscores the importance of childhood cognition as a candidate target for early intervention.

15 **124.015** Clinical Characteristics of Female Adult Autism Spectrum Disorders (ASD): (I) Development of the Adult ASD Self-Rating Scale (A-ASD)

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Background: The assessment of the Adult Autism Spectrum Disorders (ASD) is so important.
Objectives: We developed the Adult Autism Spectrum Disorders Self-Rating Scale (A-ASD) and examined the reliability and validity of the A-ASD. At the same time, we also specified clinical characteristics of female adult ASD patients without intellectual disabilities.
Methods: The subjects were 29,525 psychiatric outpatients in Minami-Aoyama Antique Street Clinic (recent 13 years). Among them, we drew 246 ASD patients (178 males and 68 females) without intellectual disabilities. After obtaining their informed consent, we administered the A-ASD. It consists of 35 items. It has three factors, autism spectrum disorders (Factor 1), psychiatric comorbidity (Factor 2), and other neurodevelopmental disorders including ADHD (Factor 3)
Results: Cronbach alpha was approximately 0.9, indicating that internal consistency was adequate. There were significantly positive rest-retest correlations. Both the sensitivity and specificity were more than 80%. Thus, the reliability and validity were supported although we could not examine all types of the reliability and validity. However, both the sensitivity and specificity in females were less than 70%. We added 3 items on feminine emotions and behaviors to the same-sex women and reexamined the reliability and validity in female adult ASD patients. As a result, they were 78% and 80%, respectively. Finally, two different versions by gender were completed.
Conclusions: We have to pay close attention to female-specific characteristics to same-sex women when we perform a psychiatric diagnosis of female adult ASD without intellectual disabilities.

16 **124.016** Community and Facility-Based Employment of Adults on the Autism Spectrum

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Background: Approximately half of young adults with autism experience employment at least once between high school and their early twenties. The Workforce Innovation and Opportunity Act of 2014 and Employment First philosophy guide policy for people with disabilities in the U.S. and focus on increasing opportunities to experience community-based jobs with sustainable wages. However, we know little about the employment settings that adults with autism experience, particularly as they age further into adulthood.
Objectives: To describe the paid employment experiences of 1,991 adults, ages 30 to 65 years, on the autism spectrum who receive services through a state ID/DD service agency. Additionally, we explored factors associated with paid community-based employment and compared them to those associated with paid facility-based positions.
Methods: We analyzed findings from the National Core Indicators Adult Consumer Survey of adults with intellectual disability (ID) or a developmental disability (DD) who receive at least one service in addition to case coordination through their state ID/DD agency. There were 4,000 participants with autism in the 2014-15 ACS representing 32 states and one region. We used bivariate statistics and logistic regression to identify correlates of paid employment of each type.
Results: Most respondents were white (70%), non-Hispanic (89%), male (72%), with co-occurring ID (87%). One-fifth and had a co-occurring DD (21%). About half (59%) primarily used spoken language; had a legal guardian (53%); took medication to treat mood disorders, anxiety, or psychotic disorders (59%) or for behavioral challenges (47%); and received any Home and Community Based Services funding (56%). A small percentage received ICF/ID funding (8%). Overall, 29% held paid employment in the two weeks prior to the survey. In total, 12% worked for pay in the community - averaging 29 hours and earning $231/biweekly – and 18% worked for pay in a facility-based position- averaging 34 hours and earning $73/biweekly.
Community-based employment was significantly less likely for those who were black (OR: 0.40); female (0.56); used primarily non-spoken expression (0.19); took medication for behavior problems (0.64); or had moderate (0.38), severe (0.23), or profound ID (0.23). Community-based employment was significantly more likely for those with co-occurring DD (1.71). Adults with mild ID were more likely than adults who have no ID to have facility-based employment (OR: 1.74), while adults with profound ID were less likely (0.44). Adults who received ICF/ID funding were more likely to have a facility-based position (3.66).
Conclusions: This study describes the low employment rates and the associations with community versus facility-based paid employment for a sample of adults with autism in a large state-based survey. Future study might explore how services and supports such as Vocational Rehabilitation and Social Security Benefits influence community-based versus facility-based outcomes.

17 **124.017** Comparing Perceptions of Young Adults with Autism and Their Caregivers on Employment and Vocational Rehabilitation Needs

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Background: It is estimated that 50-75% of adults with Autism Spectrum Disorder (ASD) are unemployed (Hendricks, 2010). ASD symptomology has been found to interfere with the ability to obtain and maintain employment (Seaman & Cannella-Malone, 2016). Vocational Rehabilitation (VR) programs are intended to assist individuals with ASD with job searches and the acquisition of necessary skills to obtain employment. However, adults with ASD report difficulty accessing effective VR services (Lawer et al., 2009).
Objectives: Caregivers and young adults (YA) with ASD were recruited to provide insight into accessibility and helpfulness of VR services, as well as perceived importance of specific employment factors.
Methods: Sixty-one caregivers and their YA children (ages 18-26) with an ASD diagnosis were recruited via the Interactive Autism Network (IAN) Research Database at the Kennedy Krieger Institute and were asked to complete an online survey. Survey items covered skills necessary for employment, future plans, and goals related to employment. Frequency analyses were conducted to determine accessibility and helpfulness of specific VR programs. A paired samples t-test was used to compare YA and caregiver reports.
Results: Both caregivers and YAs reported having access to a variety of VR services. Caregivers reported diagnostic/medical services to be the most helpful (endorsed by 14.8%), whereas YAs reported vocational evaluation and training to be the most helpful (endorsed by 11.5% each). Over 50% of the sample did not list VR services as being available or helpful.
Caregivers had significantly different perspectives than YAs regarding the perceived helpfulness of several VR services, including practice interviewing, guidance on self-disclosure, support to increase self-determination, trying out different jobs, interviewer education about ASD, practical skills related to the career field, social skills involving coworkers and strangers ($p<0.05$), and VR representatives having special training in ASD ($p<0.01$). On average, caregivers rated practicing skills related to career field as the most helpful service ($M=3.73, SD=0.55$), while YAs rated practice interviewing ($M=3.42, SD=0.84$) as the most helpful.
Caregivers also had significantly different perspectives than YAs regarding the perceived importance of specific employment factors, including enjoyment of the job, friendly work environments, advancement into long-term careers, and bosses and coworkers who understand the effects of ASD ($p<0.01$). On average, caregivers rated friendly working environment as the most important employment factor, ($M=3.92, SD=0.33$), while YAs rated enjoyment of the job ($M=3.49, SD=0.92$) as the most important.
Conclusions: Findings regarding the helpfulness of specific VR services indicate that applied practice of skills would be most beneficial to individuals with ASD who are seeking employment. Findings regarding the perceived importance of employment factors indicate that ASD-friendly workspaces are crucial, as is enjoyment of the job itself. Finally, with over one half of the sample neglecting to report access to effective VR services, it is important for future research to focus on improving access to helpful services.

18 **124.018** Contested Family Perspectives: Implications for Independent Living of Adults with ASD

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Background:
Adults with ASD have multiple abilities and disabilities across a wide range of social and functional areas of daily living which influence their support needs. Many continue to be supported by their ageing parents. While independent living may be an expectation and desired goal for adults with ASD, outcome studies report few achieve independent living, with most requiring continued support. Additionally, the timing of independent living for adults with ASD may occur in middle age and beyond, often when parents are unable to continue providing support. Few studies have explored the essential capabilities and support needs of adults with ASD for the achievement of independent living. This study underscored how contested perceptions of capabilities and needs may have implications for how and with whom support needs assessments are conducted and how support is provided.
Objectives:
To explore the current daily living capabilities and anticipated future support needs for independent living of adults with ASD, from theirs and family members' perspectives.
Methods:
Using a cross-sectional mixed methods research design, 74 adults with ASD (19-65 years of age), recruited from a London clinic completed the Camberwell Assessment of Need for Adults with Developmental and Intellectual Disabilities (CANDID) and 49 family members participated in semi-structured, face-to-face interviews to explore the capabilities and support needs of adults with ASD. SPSS was used to analyse quantitative data and thematic analysis conducted on qualitative information.
Results:
Findings revealed conflicting perceptions of the capabilities and support needs of adults with ASD reported by adults themselves and by family members. On quantitative measures adults with ASD self-reported higher support needs which contradicted what they expressed in qualitative interviews. Adults with ASD stated it was difficult for them to know, describe and express what they needed. In comparison with family members, adults with ASD frequently described their capabilities and expectations of independent living to be higher and support needs lower than what family members perceived them to be. Family members expressed concerns for the safety and wellbeing of adults with ASD and the need for support to achieve independent living.
Conclusions:
While not implying one perspective is better or more 'truthful' than another, findings highlight discrepancies between the expressed abilities and support needs of adults with ASD which may require consideration for how needs are assessed, and support provided. Face-to-face, detailed closed ended questions may provide a more accurate assessment of the abilities and support needs of adults with ASD than open ended questions. Deficits in executive function may make it difficult for adults with ASD to anticipate the future, inevitable changes that may occur and the tasks with which they may need support. Adults with ASD may underestimate their future support needs and parents may over estimate them. Social services may not appreciate the gravity of adults with ASD's need for support and possible consequences of its absence. Under or over estimating competencies and support needs of adults with ASD may impact their wellbeing and safety

19 **124.019** Convergence of Self-Report and Informant Measures of Executive Function for Adults with ASD

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Background: The number of adults with Autism Spectrum Disorder (ASD) is rapidly increasing, and with it, the need for appropriate assessment instruments to better understand this population. Self-report measures are widely used for both research and clinical assessment of adults with ASD, though there is little research examining the convergence of self- and informant-report in this population.
Objectives: This research capitalized on a unique dataset of adults diagnosed with ASD as children by the TEACCH Autism Program from 1970-1999. The present study examined agreement between Caregiver- and Self-Report on the Behavior Rating Inventory of Executive Functioning–Adult Version (BRIEF-A; Roth & Gioia, 2005).
Methods: Caregiver surveys were completed for 274 adults with ASD in middle adulthood. Of this sample, 25 adults with ASD (age range: 27-57, M = 35.1) and their caregivers completed the Self- and Informant-Report versions of the BRIEF-A during in-person follow-up testing. The self-report form of the BRIEF-A was only administered to individuals with a full-scale IQ (FSIQ) of 70 or higher (FSIQ range: 73-120, M = 92.24).
Results: Caregiver and Self-Report t-scores on the BRIEF-A Global Executive Function Composite (GEC) were significantly correlated (r = .73, p < .01). Scores on the Behavioral Regulation and Metacognition indices also demonstrated significant, positive correlation (r = .75, p < .01; r = .64, p < .01, respectively). There was not a significant difference between Caregiver and Self-Report t-scores for the GEC (Caregiver M=56.28; Self-Report M=54.92). However, for two subscales, Self-Monitoring and Organization of Materials, Self–Report t-scores were significantly lower than Caregiver t-scores (t = 2.00, p < .05; t = -2.49, p < .05, respectively). Discrepancy scores were calculated by subtracting Self-Report t-scores from Caregiver t-scores on the GEC and on each subscale. Discrepancy size was significantly negatively correlated with the FSIQ of the adults with ASD. Larger discrepancies between Caregiver and Self-Report were associated with lower FSIQ scores (r = -.58, p < .01). Discrepancies were largest for individuals with FSIQs below 85, with the adults with ASD reporting significantly fewer executive function impairments than their caregivers reported about them.
Conclusions: The BRIEF-A demonstrated acceptable levels of inter-rater agreement when used to measure executive functioning for adults with ASD and did not show overall differences in t-scores for Caregiver and Self-Report version. However, cognitive ability was significantly related to the size of difference between Caregiver and Self-Report. Because individuals with lower FSIQs may have more difficulty accurately reflecting on their own impairments, under-reporting executive function issues may result in disqualification from services and, more broadly, an inaccurate understanding of executive function abilities in this population. For individuals with lower cognitive abilities, gathering information from multiple sources is important for a more complete assessment of functioning than gathering information from an adult or caregiver alone.

20 **124.020** Correlation of Medical Comorbidities and Medication Use in Adolescents and Adults with Autism Spectrum Disorder

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Background: The prevalence of adults with autism spectrum disorders (ASD) is increasing. However, little is known about the frequency of medical comorbidities and related medication use in adults with ASD. Psychotropic medications are often used in patients with ASD, but the pattern of use is poorly understood. Here, we report the on the frequency of medical comorbidities and medication use in a primary-care based population of adolescents and adults with autism.
Objectives: To examine medication use patterns in adolescents and adults with autism
Methods: The Center for Autism Services and Transition (CAST) is a primary care based effort to improve medical care for adolescents and adults with ASD. A retrospective chart review was done of all patients seen in the CAST clinic between April 2014 and April 2015. Data collected included demographics, diagnoses, and medications at the time of initial clinic presentation. Associations between comorbidities and medication classes were assessed by chi-square tests. All statistical tests were evaluated at the α=0.05 significance level.
Results: Â We reviewed 143 charts. Age ranged from 7 to 45 years (mean = 20) with the majority of patients (81%) between the age of 15 and 29 years old. Frequency of medical diagnoses included: 47% (n=67) with intellectual disability(ID), 52% (n=74) with ADHD, 51% (n=73) with anxiety, 37% (n=53) with obesity (BMI >30), 32% (n=46) with a history of aggressive behavior, 29% (n=41) with depression, 22% (n=32) with seizures and 8% (n=11) with hypertension. Medication use at the time of the initial visit included 59 (41%) on SSRIs/SNRIs, 51 (36%) on atypical (2nd generation) antipsychotics, 42 (29%) on antiepileptics, 35 (25%) on non-stimulant ADHD treatments, 36 (25%) on sleep aids, 34 (24%) on stimulants, 31 (22%) on benzodiazepines, 19 (13%) on stool softeners, 12 (8%) on non-SSRI/SNRI antidepressants, 12 (8%) on 1stgeneration antipsychotics, and 9 (6%) on antihypertensives (refer to Table 1. Additionally, 48 patients (34%) reported current use of complementary and alternative medicines with an additional 15 patients (11%) reporting previous use of complementary and alternative medicines. The average number of different medication classes was 3.0 for patients with ID and 1.9 for patients without ID. Further statistical analysis was performed to better understand the relationships of different comorbidities with specific medication class usage with a particular focus on ID, seizures, and history of aggressive behavior. These data are provided in Table 2.
Conclusions: In our primary care-based population of adolescents and adults with ASD, medication use is common with many patients being on multiple medications. We found higher rates of psychotropic medication use in patients with ID, seizures, anxiety, and a history of aggressive behavior. It is likely that patients with ASD are less able to self-advocate their needs than the general population, thus putting them at higher risk for complications related to medication use and polypharmacy. These data highlight the need for careful monitoring and awareness of risks of polypharmacy in adolescent and adult patients with ASD, particularly if they have intellectual disability, seizures, or a history of aggressive behavior.

21 **124.021** Criterion-Related Validity of the Theory of Mind Inventory-2 Self-Report Form for Adults with Autism Spectrum Disorder

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Background:
From identifying areas of strengths and challenges to assessing intervention efficacy, detailed social functioning measures are needed to best support individuals with ASD across the lifespan. Self-report tools in particular empower individuals to share their experiences in a meaningful way. The Theory of Mind Inventory-2, originally developed as a caregiver-report measure of theory of mind, has been adapted to a self-report format. Limited theory of mind is characteristic of ASD which has implications for a range of social skills, including gaze perception. To understand the utility of this measure, we compare the ToMI-2-SR to other self-reports of social skills as well as to eye tracking outcomes in a population of young adults.
Objectives:
1) To examine how the self-report form of the ToMI-2 is comparable to other social skills measures and eye tracking outcomes
2) To examine whether the ToMI-2-SR adds unique variance above and beyond existing measures of social functioning
Methods:
A total of 36 young adults (M_{age}*(SD)*= 20.5 (*2.2*), Average brief IQ = 113.0 (*13.5*), 41.7% female, 42% with a diagnosis of ASD or PDD) completed an eye tracking task and self-report questionnaires: Theory of Mind Inventory-2- Self Report (ToMI-2-SR), Social Responsiveness Scale (SRS), and Adult Self-Report (ASR). Four eye tracking conditions mimicking different gaze detection scenarios (averted gaze, mutual looking, getting caught staring, and catching another staring) were presented and four eye tracking outcomes are examined. Between group effects and bivariate correlations were conducted to explore theoretically-based tests of construct validity. More specifically, Pearson correlations were calculated between the ToMI-2-SR Advanced subscale, the SRS (Social Cognition and Social Communication subscales), ASR (Withdrawn and Thought Problems scales), and eye tracking outcomes (interest area (IA) dwell time, trial dwell time, IA first and second fixation duration).
Results:
A significant group difference emerged between the ASD/PDD group and the typically-developing group ($t(34) = 4.53$, $p<.001$ on what?. The ToMI-2_SR Advanced subscale was significantly correlated with the Social Cognition ($r=-.67$, $p<.001$) and Social Communication ($r=-.72$, $p<.001$) subscales of the SRS, as well as the Withdrawn ($r=-.50$, $p<.005$) and Thought Problems ($r=-.52$, $p<.005$) scales of the ASR. IA and trial dwell time were significantly correlated with ToMI-2-SR across all conditions except 'averted.' First fixation duration was significant in the averted condition ($r=-.44$, $p<.01$). Second fixation duration was significant in the 'getting caught staring' condition ($r=.36$, $p<.05$).
Conclusions:
Correlations between the ToMI-2-SR and other ASD-related scales were significant (and consistent with previous results using the caregiver version of the ToMI), providing evidence of criterion-related validity of the self-report form. Of particular interest is that correlations between eye tracking outcomes and the ToMI-2-SR followed a different pattern of correlations than between eye tracking outcomes and other measures of social skills. The unique contribution of the ToMI-2-SR has important implications for understanding gaze detection and social functioning. As adults with ASD continue to advocate for themselves (nothing about us without us!), well-established self-report measures will serve an increasingly key role in including individuals with ASD in their own care.

22 **124.022** Does Baseline Rsa Play a Role in Social Skills and Sensory Sensitivity in Adults with Autism Spectrum Disorders?

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Background:
There is increasing scientific attention for the possible relationship between autonomic functioning and ASD symptoms. The evidence is rather mixed. Some find no differences between people with and without ASD in autonomic functioning during sensory or social stimulation, whilst others find atypical reactions in people with ASD (see review of Klusek et al., 2015). The major focus, so far, was on autonomic responses. However, some suggest that baseline levels of autonomic functioning might be more important (e.g., Porges et al., 2013).
Objectives:
We examined whether baseline respiratory sinus arrhythmia (RSA) is related to social skills and sensory sensitivities in adults with and without ASD.
Methods:
38 ASD and 39 typically developing (TD) males (aged 18-45, mean=31.4; IQ>70, mean=104.5) were included. Baseline RSA was measured with an electrocardiogram and the VSRRP98 of the local university. Social skills were measured with a Dutch self-report social skills questionnaire ('Inventory of Interpersonal Situations'). Sensory sensitivities were measured with the Adolescent/Adult Sensory Profile. For the current analyses a sensory sensitivity total score was calculated. We performed two multiple regression analyses with, respectively, sensory sensitivity and social skills as dependent variables. In both analyses, the predictors were baseline RSA and Group (ASD vs. TD) in step one and an interaction (Group*Baseline RSA) in step two.
Preliminary Results:
The groups did not differ in age or IQ. Regarding sensory sensitivity, the preliminary results showed that in step one the model explained 35.4% of the variance. After adding the interaction, the model explained a similar amount of variance (R^2 *change*=.00) and did not result in significant additional explained variance. Only group was a significant predictor (ASD>TD; β=-29.80, p=.00). Regarding social skills, similar findings were observed as the model explained 37.4% of the variance in step one and adding the interaction did not result in a significant increase in explained variance (R^2 *change*=.001). Again, only group was a significant predictor (ASD<TD; β=21.72, p=.00).
Conclusions:
These preliminary findings suggest that baseline RSA is not related to social skills and sensory sensitivity in adults with or without ASD, over and above group. Group is a relevant factor, which was to be expected as altered social skills and sensory sensitivities are at the core of ASD. Future research needs to determine whether an altered physiological ability to adapt to the environment is a better candidate to elucidate the potential relationship between autonomic functioning and ASD symptoms.

23 **124.023** Driving Anxiety in Individuals with Autism Spectrum Disorder

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Background: Compared to 87% of the general population, only 25% of adults with Autism Spectrum Disorder (ASD) consider themselves independent drivers. Despite this low frequency of driving and its importance to overall quality of life, current transportation safety research among drivers with ASD is sparse and limited to survey data. These survey data have identified driving anxiety as a commonly reported driving barrier for individuals with ASD. Anxiety response comprises three components: physiological (i.e., increased heart rate), cognitive (i.e., anxious thoughts), and behavioral (i.e., avoidance of feared situations).
Objectives: The current study examined each of these components in individuals with ASD and the ability of anxiety to predict simulated driving performance.
Methods: Sixteen drivers with clinical diagnosis of ASD and sixteen drivers with typical development (TD) matched on age (M_{age} = 22.94, SD = 4.25), gender (94% male), and driving experience (months since permit received; M = 93.41, SD = 50.39) were recruited. Participants wore a Polar activity sensor band to record average heart rate (AHR) – a physiological measure of anxiety – as they completed a 10-mile simulated drive. The simulator automatically collected driving performance outcomes. Participants also completed questionnaires assessing demographic characteristics, driving frequency (behavioral), and the Scale of Apprehensive Driving (SAD) assessing driving anxiety (cognitive). Independent samples t-tests were conducted to examine group (ASD vs TD) differences in driving frequency, as well as cognitive and physiological driving anxiety. Full factorial linear regressions were also conducted to examine diagnostic group, physiological and cognitive driving anxiety, and the interaction of anxiety and group (GroupxAHRxSAD) as predictors of driving performance. The continuous predictors (AHR, SAD) were centered to reduce multicollinearity when including the interactions in the model.
Results: Drivers with ASD (M = 4.31, SD = 2.75) drove fewer days per week (M = 6.19, SD = 1.52), t(30) = -2.39, p < .01, and showed higher self-reported driving anxiety (M = 23.88, SD = 3.70) compared to TD drivers (M = 23.88, SD = 3.70), t(30) = 2.14, p = .03. No group differences were found for AHR, t(30) = -.844, p = .95. Higher self-reported driving anxiety (F(4,29) = 3.24, p = .03) predicted slower driving speed. The linear regression indicated that neither group, AHR, nor GroupxAHRxSAD predicted other simulated driving performance outcomes (i.e., motor vehicle collisions, reaction time, lane deviation).
Conclusions: Drivers with ASD reported higher levels of driving anxiety, but showed no differences in AHR compared to TD drivers. Diagnostic group was not a predictor for driving performance; however as psychological anxiety symptoms increased, drivers tended to drive more slowly, possibly as a compensatory mechanism. These finding may suggest that drivers with ASD can regulate their physiological anxiety symptoms while driving, but may drive less often than TD drivers due to their anxiety's psychological component. Study findings indicate diagnosis of ASD does not predict decrements in simulated driving performance. The current study suggests that targeting the psychological component of driving anxiety through evidence-based interventions (i.e., cognitive behavioral therapy) in the ASD population may increase rates of independent driving.

24 **124.024** Driving Performance of Drivers with Autism Spectrum Disorders: A Simulator Study

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Background: Driving is an important step for transitioning into adulthood as it cultivates a sense of autonomy and can help secure employment and social relationships. In order to be safe on the road, drivers are required to demonstrate a range of driving knowledge and skills related to traffic regulations, speed control, lane positioning, vehicle control, safe distance to others, anticipation and management of hazardous situations. Individuals with ASD often have more difficulties with executive functioning, which include processing speed, working memory, attention, mental flexibility, planning, and also difficulties in the ability to anticipate events. Due to the characteristics of autism and the nature of driving, driving can be challenging for drivers on the autism spectrum.
Objectives: This study aims to examine how drivers with Autism Spectrum Disorder perform during an unanticipated driving scenario in comparison with neurotypical drivers using a driving simulator.
Methods: Seventeen drivers with Autism Spectrum Disorder and 18 drivers without underwent a driving simulation (STISIM M300WS) in an urban setting consisting of a critical driving scenario. Driving mistakes and performance outputs on the driving simulator and the self-reported driving history on the Driving Behaviour Questionnaire were analysed.
Results: Drivers with Autism Spectrum Disorder reported significantly more lapses on the Driving Behaviour Questionnaire and committed more driving mistakes on the driving simulator than drivers without. Drivers with Autism Spectrum Disorder were also slower to react to the abrupt changes in traffic lights. However, drivers with Autism Spectrum Disorder drove less closely to vehicles in front, measured by time to collision (TTC), and were less likely to tailgate other vehicles.
Conclusions: Drivers with Autism Spectrum Disorder may be less efficient in responding promptly to critical driving scenarios that require prompt identification of and reaction to hazards but they appear to be safe drivers with respect to keeping distance to cars in front. Driver education should emphasise on the critical response of drivers with Autism Spectrum Disorder in different driving scenarios.

25 **124.025** Evaluating a University Mentoring Program: Outcomes for Students with ASD and Other Disabilities.

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Background: Increasing numbers of students with autism spectrum disorder (ASD) are entering higher education. Their success can be jeopardized by organizational, social/emotional, and academic challenges if appropriate supports are not in place. Mentoring as an intervention strategy has received increasing attention in the literature. While the majority of previous work has focused on at-risk youth populations, students with ASD and other disabilities may be particularly responsive to a mentoring model.
Objectives: The present study examined the outcomes of a mentoring program for students with ASD and other disabilities. We were interested in how and to what extent having a mentor impacted the participants. For a subset we also compared academic outcomes (retention, credits earned, GPA) with a matched comparison group who did not receive mentoring.
Methods: Participants were 46 first year students registered with Student Disability Services (SDS), 36 were male and 10 were female with an average age of 21 years. All participants provided documentation of a disability prior to their eligibility for SDS services and the majority had an ASD diagnosis. Mentors were upperclassmen and were matched with mentees based on availability schedules and major. A subset of participants were matched with a comparison group registered with Disability Services who did not participate in the mentoring program.
Pairs met once a week for an hour for 14 weeks and followed a program curriculum focused on time management, stress management, accessing resources, study skills, dorm life, classroom etiquette, communicating with peers and professors, and working in groups.
Mentees completed a “Program Questionnaire” pre and post intervention designed to measure the effectiveness of the program curriculum. Questions focused on how prepared for university the mentees felt, whether they understood how things work at university, how confident they felt, etc. The post-measure also asked participants to rate how much they attributed any changes specifically to having a mentor.
Results: Significant changes were seen in feeling less worried about being successful, understanding academic expectations, knowing how things work at the university, knowing how to access supports, and where to find opportunities to meet others. Mentors had the most impact in knowing how things work at the university, knowing how and where to find opportunities to meet others, and managing time and organization.
There were no significant differences between a subset of those in the mentoring program and a matched comparison group for number of credits earned or GPA. Four students in the mentoring program had dropped out compared to two in the comparison group.
Conclusions: Â Mentoring programs can be an effective support mechanism for university students with ASD. However, mentoring might be limited in its impact. Whereas meeting regularly with a peer mentor may enhance students’ ability to manage workload and access resources, it less likely to effect retention, or significantly affect academic performance.

26 **124.026** Evaluation Adults with an Asd's Perceptions of Employment and Educational Supports

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Background: Recent studies indicate the lifetime costs of supporting individuals with an ASD at $2.4 million for individuals with an ID and $1.4 million for individuals without an ASD (Buescher, Ciday, Knapp & Mandell, 2014). These estimates strongly suggest that improving educational and employment outcomes for adults with an ASD is imperative. Rates of participation in higher education and competitive employment continue to be low (Shattuck et al. 2012, Renty and Roeyers, 2006). Many higher education institutions are beginning to explore development of supports for this growing population, but limited information regarding what supports are most beneficial for retention of students with an ASD and transition to work after graduation is known (Zager & Alpern, 2015, Camarena & Sarigiani, 2009). With regard to employment, federal legislation now requires agencies seek employment opportunities for individuals with disabilities at the highest level, i.e competitive employment (https://www.dol.gov/odep/topics/EmploymentFirst.htm). Input from consumers and collaboration with employers is an essential component of determining which supports are most helpful in the work setting.
Objectives: Evaluate the perceived effectiveness of common supports provided to individuals with an ASD in school and work settings and factors which positively or negatively influenced participation.
Methods: Descriptive survey (n=59), adults with an ASD, ages 18-35. Likert scale (5 and 4 point, very helpful-not helpful, strongly agree-disagree or neutral) for perceived effectiveness of educational and employment supports, respondents perceived feelings of success in the work setting and demographic information, e.g. educational level, living situation. Additional data gathered regarding selection of PSE institutions, types of employment and outside hobbies and interests was also included.
Results: Basic supports such as faculty and boss/supervisor mentoring were rated most favorably (44% and 63% respectively), indicating low cost or free supports may be of most benefit above more specialized supports.Â Academic specific supports such as tutoring and extended testing time were also rated as “very helpful” by 29% and 41% respectively by college participants.Â Of respondents, 52% attended college and 71% percent indicated that they been employed at least once. Six percent of respondents who attended college reported that they obtained work in their area of study after graduation indicating that ability to obtain competitive and meaningful employment is still a concern. Management of anxiety and social relationships were most frequently reported as negative aspects of work. Commonly recommended supports such as vocational rehabilitation were noted as least helpful by respondents. Low rates of participation with career counseling, resume writing and interview preparation were noted and indicate that that adults with an ASD may not be accessing important resources.
Conclusions: Individuals with an ASD may benefit most from non-disability supports in the educational and work setting such as faculty and employer mentoring, flexible work schedules and opportunities to work from home. Addressing consumer specific challenges such as anxiety and social relationships are an important component of programming. Continued input from consumers regarding supports is an important component of program evaluation.

27 **124.027** Examining Daily Living Skills in Adults with Autism Spectrum Disorder

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Background: Daily living skills (DLS) are the often taken-for-granted everyday activities needed for independent adult life. For adults with autism spectrum disorder (ASD), DLS are a predictor of employment success and post-secondary education (Gray et al., 2014; Klinger, et al., 2015). Across the life span, DLS for individuals with ASD lag behind non-disabled peers regardless of intellectual ability (Bal et al., 2015), with adults having the most significant deficits in community skills (Matthews et al., 2015). However, studies investigating DLS in adults are limited and lack detail regarding specific strengths and challenges.
Objectives: The objectives of this study were to examine the factor structure of DLS and to identify areas of strengths and needs at the factor and item level for adults with ASD based on conversational ability to inform the development of targeted interventions.
Methods: Caregivers of 274 adults diagnosed with ASD completed the Waisman Activities of Daily Living Scale (W-ADL), a 17-item scale developed for individuals with developmental disabilities. An exploratory factor analysis of the W-ADL using a varimax rotation was completed. The mean score for each subdomain and each item were calculated. In addition, the level of independence was calculated for each item. A one-way ANOVA was conducted to compare the effect of conversation ability on DLS. Within each conversation group, mean scores for each subdomain and level of independence on each item was calculated.
Results: Results of the factor analysis revealed a three-factor solution: Instrumental Activities of Daily Living (IADL), Self-Care and Simple Domestic Skills (SC), and Eating. Mean scores were: IADLs: 5.87 (Max score = 14), SC: 11.82 (Max score = 16), and Eating: 3.88 (Max score = 4). Only 8% percent (*N*= 22) of the sample received the maximum total score of 34, which reflects skills of a typical adult. Nearly all adults (95%) were independent in Eating. In the subdomain of SC, over 75% were independent with toileting and dressing but only 44% completed simple household tasks independently. In the IADL subdomain less than 20% were independent preparing a complete meal, doing basic home repairs, and managing finances. There was a statistically significant difference between conversation groups on SC and IADLs but not Eating, with those in the “good conversation” group showing the most independence, and those in the “no conversation” group being the most dependent across subdomains (see Table 1). However, those in the “good conversation” group still had significant deficits in IADLs (*M*= 9.3; Max score = 14) and less than 40% being independent in more complex activities.
Conclusions: As expected, conversation ability predicted DLS. Those with good conversation ability demonstrated strengths in Eating and SC but continued to have significant challenges with IADLs, skills considered essential for independent living. Results indicate a need for individually tailored interventions for individuals across the life span and across the spectrum. Programs designed to address IADLs of those with good conversation skills are crucial while interventions aimed at increasing independence in SC should be targeted for those with more significant conversation challenges.

28 **124.028** Examining Environmental Predictors of Social Participation and Service Use for Adults with ASD Using Geographic Information Systems (GIS)

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Background: Limited research on adults with ASD reports poorer community participation and social interaction compared to both typically developing peers and those with other disabilities (Liptak et al., 2011, Orsmond et al., 2013; Roux et al., 2013). Where adults live, including size of community and proximity to resources may be important environmental factors influencing participation and service use, but are rarely studied in this population (Badia et al., 2011).
Objectives: A geographic information systems (GIS) approach was used to systematically examine whether size of community and distribution of community resources contributed to community participation and service use outcomes for adults with ASD.
Methods: Outcomes were reported by 124 caregivers of adults (aged 21-54, M = 34.8) who were diagnosed with an ASD as children. Caregivers completed the TEACCH Autism in Adulthood Survey assessing adult outcomes, including community participation and service use. GIS mapping determined the population density where the adult lived, as well as how accessible it was to various features, including bus stops, grocery stores, coffee shops, religious organizations, and health care (see example in Figure 1). Accessibility was measured by both proximity to and density of features relative to the home location. Regression analyses examined whether these GIS measures predicted adult outcomes and service use, while also accounting for adult age, conversation ability, childhood IQ, and activities of daily living (ADL) skills.
Results: Results indicated that while person factors of better conversation ability and greater ADL skills significantly affected outcomes, community size was not significantly related to outcomes. Specifically, those from more and less densely populated areas had similar outcomes across a variety of domains including employment, social activity, adult well-being, and access to services. However, accessibility to specific features in the community such as public transportation and religious organizations were significant predictors of outcomes; those with better access to these features had better outcomes than those with poorer access. For example, greater access to religious organizations in the community was related to more frequently getting together with friends outside of organized activities or groups ($p < .001$) and increased involvement in community activities (volunteering and attending religious services) ($p = 0.02$; $p = .01$, respectively). Similarly, greater access to public transportation was related to use of a greater number of services in the last two years ($p < .001$). Accessibility to public transportation was also a significant predictor of increased satisfaction with services overall ($p = .008$) and was one of the significant predictors of better wages from employment ($p< .001$).
Conclusions: These findings suggest it is not the size of the community but access to specific community features such as public transportation and religious organizations that are important environmental considerations impacting social participation and service use for adults with ASD. As the numbers of adults with ASD increases and families focus on identifying factors associated with improved quality of life, these findings suggest that communities that provide opportunities for community integration via public transportation and religious organizations are important components in supporting positive adult outcomes.

29 **124.029** Executive Function Abilities in Individuals Receiving an Autism Spectrum Diagnosis in Adulthood

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Background: Little is known about cognition in autism spectrum disorder (ASD) across adulthood, especially in later-life. In typical ageing, executive functions are particularly sensitive to age-related decline. Difficulties in some domains of executive function have been observed in ASD, but it is unclear whether older adults with ASD will show the same pattern of age-related change as typical adults.
Objectives: To examine executive function abilities in adults with ASD, including both gender differences and associations with age.
Methods: We examined the profile of cognitive abilities and autism traits in a group of 134 adults (97 males) receiving a first diagnosis of ASD in adulthood according to DSM IV or V criteria. Participants were assessed in a specialist adult diagnostic clinic, were aged between 18 and 75 years and all had abilities within the normal range on neuropsychological assessment. Executive function abilities were measured using age-normed scores for: Digit Symbol and Digit Span (Wechsler Adult Intelligence Scale-III or IV), Brixton, Hayling, Trails A and B, Key Search and Zoo Map (Behavioural Assessment of the Dysexecutive Syndrome). A composite score for executive function (Mean EF) was computed. Autism traits were measured using the self-report Autism Spectrum Quotient (AQ), Empathy Quotient (EQ), and Systemising Quotient (SQ).
Results: Few gender differences in ASD were observed across the measures. Women scored significantly higher than men on the Digit Symbol task, and reported higher AQ scores but this did not reach statistical significance. Correlations between age and executive function measures were calculated using age-corrected test scores; therefore one would not expect a significant correlation with age if individuals with ASD show the same age-related differences as typical adults. Results demonstrate a significant positive correlation between age and Digit Symbol as well as both Trails A and Trails B, indicating that as age increases performance on these measures is improving beyond typical adult performance. Age correlated significantly with self-rated scores on both AQ and SQ, indicating that self-rated scores increased with age.
Conclusions: In a group of adults without intellectual disability receiving a first ASD diagnosis in adulthood, few gender differences in executive function were observed. In some but not all executive function tasks, significant correlations were observed between age and performance. Results suggest that for some abilities relying on speed and sequencing, late-diagnosed individuals with ASD may demonstrate better performance than typical age-matched peers. Although these results are in keeping with ASD being protective against typical age-related decline, longitudinal studies are required to investigate this fully.

30 **124.030** Executive Function and Its Relation to Outcomes in Middle Adulthood

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Background: Â Executive function (EF) is defined as one's ability to manage oneself and one's resources including planning, monitoring, and cognitive flexibility (Welsh & Pennington, 1988). The literature documents EF deficits for those with ASD throughout childhood and adolescence (Kenworthy et al., 2008), but little is known about how EF manifests in middle adulthood and its relations to adult outcomes. This is of critical importance because over 50,000 individuals with ASD turn 18 each year suggesting the need to better understand predictors of adult outcomes.
Objectives: The current study investigated EF abilities and its relation to outcomes in adults diagnosed with ASD as children between 1970 and 1999 at the UNC TEACCH Autism Program.
Methods: Participants included 50 adults with ASD (age range 27-57; *M* age=37.2) who completed assessments measuring IQ (Stanford Binet-5; FSIQ range 40-120; *M* FSIQ=69.7) and confirm autism diagnosis (ADOS-2). Caregivers of adults with ASD completed measures assessing their adult's EF (BRIEF-Adult Version), quality of life (QOL-Q), adaptive behavior (Vineland-II), internalizing symptoms (ADAMS), and social functioning (SRS-2). Analyses were conducted to examine the relation of EF to areas of adult functioning.
Results: Bivariate correlations were conducted to assess the relationship between EF and nonverbal IQ (NVIQ), as the literature suggests a connection between these domains. When including the whole sample, there was no significant relationship between EF and NVIQ (r=-.06, p=.69). Because our sample had a large range in NVIQ standard scores (range=42-114; *M* NVIQ=71), we further probed this relationship by dividing the sample into those with NVIQ>70 (N=27) and NVIQ<70 (N=23). For those with NVIQ>70, there was a significant negative correlation between NVIQ and EF, with those with lower NVIQ scores demonstrating poorer EF (r=-.39, p=.05). However, NVIQ was not related to EF for those with NVIQ<70 (r=-.24, p=.28). Indeed, some individuals with low NVIQ were rated as having no problems with EF. Individuals with NVIQ<70 seemed to be driving the lack of relationship of NVIQ to EF in the full sample, suggesting the BRIEF-A may not be valid for adults with intellectual disability (ID). Thus, we examined the relations between EF and measures of adult outcome only for those with NVIQ>70. In this subsample (N=27), EF was significantly negatively related to overall QOL (r=-.57, p=.002), satisfaction with one's life (r=-.71, p<.001), adaptive behavior (r=-.55, p=.003), depression (r=-.73, p<.001), anxiety (r=-.69, p<.001), and social functioning (r=-.65, p=.001). All relationships indicate those with poorer EF were reported to have more problems in each of these domains.
Conclusions: Â These data indicate that the BRIEF-A may not be an appropriate measure of EF for adults with comorbid ASD and ID. For adults with ASD without ID, results suggest that EF is an important factor in adult functioning and those with poorer EF were rated to have poorer outcomes across all areas assessed. Because EF is considered a domain in which interventions can lead to improved EF abilities (Kenworthy & Anthony et al., 2013), these results support the idea that adult EF programs may facilitate improved adult outcomes.

31 **124.031** Experiences of College Students with Autism Spectrum Disorder: Successes, Struggles, and Needs

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Background: Despite the growing number of college students with autism spectrum disorder (ASD; Shattuck et al., 2012), our understanding of their experiences/needs is surprisingly limited. Difficulties with anxiety, loneliness, and depression are the most commonly reported experiences of students with ASD (Gelbar, Smith, & Reichow, 2014), often stemming from non-academic aspects of college (e.g. living arrangements, social relationships, and structuring time). As a result, despite academic proficiency, students with ASD are less likely to graduate (39%) than the general student-body (52%), and students with other disabilities (41%; Gelbar, Shefcyk, & Reichow, 2015). As successful completion of a college degree is significantly related to positive adult outcomes in ASD (Newman et al., 2011), further research on this topic is needed.
Objectives: The current study aims to expand our knowledge of the academic/social experiences and mental well-being of college students with ASD, with the goal of using this information to help schools understand how to best support these students.
Methods: The current sample consists of 33 college students with ASD (48% male; age 18-57, *M*=23.0, *SD*=7.45). Using an anonymous, online survey, data was collected on participant demographics, academic/social experiences, and physical/mental health. Survey design was based on collaborations between Yale, College Autism Spectrum, and current/former college students with ASD. Data collection is ongoing.
Results:
Academic: Participants were primarily undergraduates (87.9%), studying at 4-year universities (93.1%). The majority stated being comfortable with their academic workload (69.7%). On average, participants utilized 2.5 support services, with academic advising (67%), exam accommodation (45%), and counseling/psychological services (36%) being the most commonly reported. Nearly one-third of participants desired additional/adjusted services, with housing accommodations, and improved counseling/psychological services being suggested most frequently.
Social:Â Participants reported an average of 1-2 close friends at school, with the majority (60.6%) stating that they were satisfied with their number of friends. However, most of the participants also reported feeling isolated (75.7%) or lacking companionship (87.9%) 'some of the time' to 'often'. Bullying at college was experienced by 24.2% of the sample, with the most common forms being exclusionary (18.2%), or verbal/provocative (12.1%).
Mental Health: Co-occurring psychiatric diagnoses were present in 45.5% of participants, with the most common being GAD (27.3%), SAD (18.2%), and depression (18.2%). Based on DASS-21 scores, participants reported 'severe' symptom levels of depression (*M*=13.2, *SD*=11.4), anxiety (*M*=9.6, *SD*=7.5), and stress (*M*=i5.0, *SD*=8.1) on average. Perhaps of greatest concern, 68.8% of participants reported lifetime occurrences of suicidal ideation (37.5% in the past year), including 46.9% who made plans for an attempt, and 9.4% who made a suicide attempt.
Conclusions: Similar to previous findings, the difficulties faced by college students with ASD in this study generally stemmed from non-academic aspects of collegiate life. Of particular concern were the elevated levels of loneliness, depression, anxiety, stress, and suicidal behaviors. Mirroring suggestions of the study participants, these findings would suggest colleges could help these students improve their experiences at school with support programs designed to build social skills/networks (e.g. peer-mentor programs, ASD housing/clubs), and by improving the availability and quality of counseling/psychological services.

32 **124.032** Experiences of Driving in Adults with and without ASD and Their Relationship with Self-Reported Autistic Traits

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Background: There is increasing recognition that individuals with Autism Spectrum Disorders (ASD) may experience some challenges when driving. A number of studies have reported that young adults with ASD may experience difficulties with certain aspects of driving (e.g. Cox et al., 2012; Ross et al., 2015; Sheppard et al., 2010). However only one previous study (Daly et al., 2014) has surveyed adults with ASD about their experiences when driving and that study focused only on those who were regular drivers.
Objectives: This study surveyed a large sample of adults with ASD (both drivers and non-drivers) to understand further the difficulties they face when driving and to determine how they relate to self-rated autistic traits. Individuals without an ASD diagnosis were also surveyed as a comparison group.
Methods: An online survey was created which asked about respondents' diagnostic status, age, driver status, difficulties they face while driving/ barriers to learning to drive. The Autism Spectrum Quotient (AQ, Baron-Cohen et al., 2001) was included as a measure of autistic traits. 170 individuals who reported having a diagnosis of ASD (83 female, mean age 30.4) and 204 individuals with no diagnosis (106 female, mean age 28.7) responded. Respondents were recruited through a range of online autism forums/support groups as well as other research participant recruitment websites, and local and international online communities.
Results:
Respondents with ASD were less likely to hold a driving license and to own a car than comparison individuals, and were more likely to have tried to learn but given up. However drivers with ASD did not report being involved in more accidents over the past year. Current drivers with ASD reported more difficulty than comparison individuals on every aspect of driving surveyed, including multitasking, feeling anxious, judging positions of other vehicles, interpreting other road users' behaviour, managing unexpected changes and predicting upcoming events. Non-drivers with ASD who had previously learned but given up also reported more difficulties than non-drivers without an ASD diagnosis who had given up.
AQ scores positively correlated with reported driving difficulties both in the group with ASD and the comparison group. In drivers with an ASD diagnosis, high scores on attention switching, attention to detail and communication subscales were associated with difficulties in specific components of driving. In drivers without an ASD diagnosis, high scores on the social, communication and attention switching subscales were associated with having difficulty more broadly, across multiple aspects of driving.
Conclusions: Having an ASD or high levels of sub-clinical autistic traits may be associated with difficulties when driving, both during learning and after having obtained a license. Aspects of driving that an individual finds particularly challenging may relate to their specific profile of autism features.

33 **124.033** Experiences of Individuals with Autism Spectrum Disorder Who Identify As Lesbian, Gay, Bisexual, Transgender, Queer, Questioning, or Intersexed.

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Background: While widely recognized as a serious omission, a lack of research focused on sexuality and ASD remains, and particularly the experiences of those who identify as LGBTQI. This results in minimal information available for individuals, family members, and professionals, and thus inadequate service provision for this population.
Objectives: The objective of this study was to gather preliminary data on the experiences of those who identify as LGBTQI and ASD, particularly the challenges they face stemming from these dual identities. We used a focus group qualitative analysis approach as a critical first step in exploring relatively uncharted ground, with the aim of identifying key themes and areas of need which might inform future research.
Methods: Four participants aged between 20 and 38 years with autism spectrum disorder (ASD) took part in the focus group. Participants' gender identities included male, transgender; agender/nonbinary; agender; lesbian/queer. All participants were Caucasian. Participants provided proof of a DSM-IV ASD diagnosis. An initial pilot study utilized an online questionnaire to explore issues around the experiences of those who identify as ASD and LGBTQI. Responses (n=10) were used to inform the development of questions for the focus group. The focus group included eight questions and took around 90 minutes. Two coders independently coded the entire transcription using NVivo software and identified the key themes.
Results:
Four main themes emerged from the focus group including 1) the intersectionality between ASD and LGBTQI did not present problems for the group in terms of understanding their gender identity and sexual orientation. They saw these as two separate identities. They did not endorse the hypothesis that having ASD might hinder or impair their understanding of their gender identity. They did note that one of the biggest challenges was not having the vocabulary for how they identified. This may be in part due to sparse opportunities to explore gender and sexual identity; 2) Challenges stem from others accepting their dual identities. Others, including professionals and family members, may believe the individual is confused about their gender and sexual identities because they have ASD; 3) Lack of understanding of the autism spectrum presents numerous barriers and contributes to isolation, particularly from others in the LGBTQI community. Members of the LGBTQI community, as well as professionals, often have stereotypical views of ASD presentation, thus discrediting the individual and invalidating what they say. 4) Appropriate service provision is almost nonexistent with many professionals at a loss for how to support them. In certain cases participants were shuffled from one provider to another, delaying treatment for years.
Conclusions: While some positive aspects of identifying as LGBTQI and having an ASD diagnosis were mentioned, our participants mostly described obstacles. These preliminary findings identify some key target areas for future research and programming. There is a clear need for better support, understanding, theories and practices regarding the intersection between ASD and LGBTQI issues.

34 **124.034** Facilitating Success for Students with Autism Spectrum Disorder at University

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Background:
While many adults with Autism Spectrum Disorder (ASD) have average to high intellectual capacities they still experience numerous challenges which impact on their ability to negotiate everyday life. Despite recognition of their challenges there remain few evidence-based interventions targeting the needs of this group who continue to experience poor outcomes in important life areas such as employment, education and interpersonal relationships.
Objectives:
The aim of this research was to describe the viewpoints on factors impacting on the success at university for students with ASD from the perspectives of university students with ASD, their parents and their mentors.
Methods:
Q-methodology identified the viewpoints of the 57 participants. Twenty-two students with ASD participated (15 male and seven female; mean age=24.6; SD=9.7). Eleven of the participants were mothers and three were fathers of university students with ASD (mean age=54.0 years; SD=8.7). There were six male and 15 female mentors of university students with ASD (mean age=30.9 years; SD=7.9). The analysis employed a by-person varimax rotation factor analysis.
Results:
Three distinct factors were defined by 17 sorts from all three groups; factor one accounted for 23%, factor two accounted for 15% and factor three accounted for 8% of the variance, respectively. Viewpoint one *Individualised support* was characterised by the supports that facilitate success at university for individuals with ASD at university. Viewpoint two *Contextual support* was distinguished by the supports enabling participation in a university environment. This viewpoint also highlighted the logistical issues faced by students with ASD such as time management and transportation. Viewpoint three *Social support* was defined by the supports required for students with ASD to facilitate personal interactions within the university environment. This viewpoint identified consistent support as a mechanism for managing social interactions, recognising the difficulty that bullying can pose.
Conclusions:
The unique approach of the current study, has in part addressed the noted limitations in previous literature which has called for further research into the needs of university students with ASD. While young people with ASD aspire to succeed in post-secondary education they struggle negotiating the necessary steps in achieving this goal. This study highlighted that supports need to be individualised and that university services should broaden their interventions for students with ASD, and provide both social and academic support. The environment has been proposed as a potential intervention target in ASD with approaches such as peer mentoring likely to be particularly effective. Peer mentoring may be particularly suited in supporting university students with ASD given its potential to be tailored to meet individual needs. While traditionally, peer mentor programs have focused on providing academic supports, this study suggests that this focus should extend to include social, emotional and psychological support.

35 **124.035** Gender-Identity in High-Functioning Individuals with Autism Spectrum Disorder

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Background: Â Clinical impressions indicate that within the Autism Spectrum Disorder (ASD) population that there is an overrepresentation of gender-dysphoria. However, little is presently known about the demographics of gender-identity issues in ASD.
Objectives: Â We hypothesized that there would be an increased prevalence of gender-dysphoria among those with ASD when compared to a typically developing (TD) population.
Methods: Â We surveyed gender-dysphoria with the Gender Identity and Gender Dysphoria Questionnaire in an international sample of individuals with ASD (*N*= 309, *M*=90, *F*= 219), aged (*M*=32.30 years, *SD*=11.93) and compared these rates to those of typically-developing individuals (*N*=261, *M*= 103, *F*= 158), aged (*M*=29.82 years, *SD*=11.85).
Results: Â When compared to TD individuals, individuals with ASD reported increased gender diversity ($\chi 2$= 34.06, p< 0.001, φ=0.25). Furthermore, individuals with ASD reported a higher number of gender-dysphoric traits ($t_{(569)}$ =8.6, p< 0.001, d= 0.73). Rates of GD in the group with ASD were significantly higher than reported in the wider population (OR=304.91, p<0.001). Relative to TD individuals, individuals with ASD prioritized personality aspects over gender in their romantic partner (χ^2= 52.48, p< 0.001, φ=0.56), expressed an androgynous self-concept (χ^2= 22.99, p< 0.001, φ=0.50) and reported gender as being unimportant to personal identity ($\chi 2$= 101.07, p< 0.001, φ=0.78). The ASD group reported poorer mental health than controls and belonging to a sexual or gender-diverse group worsened this effect.
Conclusions: Â Results suggest that ASD presents unique challenges to the formation and consolidation of gender identity. It is important that clinicians working with ASD are aware of the gender-diversity in this population, so that the necessary support for healthy socio-sexual functioning and mental well-being is provided.

36 **124.036** Getting Autistic People into Work: Evaluation of a Paid Internship Programme for Autistic Graduates

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Background:
Autistic individuals often face significant challenges to obtaining and maintaining meaningful employment – more so than other disability groups. Aside from the clear economic impact of this gap, the failure to get autistic people into work has a demonstrably negative effect on quality of life in a group of people who commonly have unique and valuable skillsets. In addition, those autistic individuals who *are* in full-time work are often in poorly paid, low-skill jobs that do not reflect their competencies. The UK autistic community has identified that understanding effective ways to deliver appropriate employment support is one of their top ten research priorities. Consequently, employers are beginning to offer paid work placement opportunities for individuals on the autism spectrum.
Objectives:
This research seeks to understand the benefits and pitfalls of one such British scheme implemented by Deutsche Bank, a large German global banking and financial services company, and to determine its impact on the confidence and future employability of the interns. By better understanding autistic adults' workplace experiences, and the perspective of their co-workers, we aim to highlight both challenges to address, and also factors associated with successful transition to work.
Methods:
Semi-structured interviews were carried out with 8 autistic interns (aged 21 – 27 years), all with undergraduate degrees, and their hiring managers before the start of the programme and again immediately after its completion. Before commencing the programme, interviews focussed on previous employment experiences (interns) and expectations of the upcoming programme: opportunities, possible challenges and, in particular, how they might address these challenges (interns and managers). Following the internship, interviews with both interns and managers focussed on their experiences of the internship: aspects that went well, issues that arose, and ways they were overcome. Six team members who worked alongside the interns were also interviewed following the programme. They were asked about the perceived benefits and challenges of the scheme, both for the interns and for themselves as a team.
Results:
Interviews were recorded and transcribed verbatim, and resulting data was analysed using thematic analysis. Analyses are on-going, however preliminary results from initial interviews suggest a number of key themes. Both interns and managers saw great value in the scheme, identifying benefits for the organisation (original ways of thinking, high quality of work) as well as the individuals themselves (training in key areas, experience of office environments). Managers' concerns often focussed on social aspects of the workplace, whereas the autistic interns commented on performance-based worries such as whether they have the necessary skills for the role. Managers also highlighted a range of accommodations they had made, both with respect to workplace environments and their own leadership style, to facilitate the success of the internship programme.
Conclusions:
In light of the minimal existing literature, the current study contributes to a better understanding of the experiences of skilled autistic individuals currently in work. The findings also offer suggestions that can be used to inform the creation, and successful implementation, of subsequent programmes aimed to promote employment opportunities in autism.

37 **124.037** Health Service Use and Health Seeking Behaviours of Australian Adults on the Autism Spectrum

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Background: Adults on the autism spectrum have unique health needs and frequently experience barriers to accessing healthcare related to emotional regulation, sensory sensitivity and healthcare system navigation. Many adults on the spectrum report low satisfaction with patient-provider communication and high levels of unmet healthcare needs. Difficulties with accessing healthcare may contribute to adults on the spectrum often exhibiting poorer physical and mental health outcomes in comparison to the general adult population.
Objectives: To describe the health service use and health seeking behaviours of Australian adults on the autism spectrum.
Methods: The Australian Longitudinal Study of Adults with Autism is a questionnaire-based study which aims to describe the physical and mental health, productivity, wellbeing and health service use of autistic adults in Australia aged 25 years and older. Rolling recruitment has occurred since July 2015. Participants are screened for inclusion and either emailed a link to the online version or mailed a paper copy of the questionnaire. Descriptive statistics and chi square analysis were performed. Further analysis will be conducted to account for demographic differences between groups.
Results:
Questionnaires were completed by 184 autistic adults and 129 non-autistic adults. Autistic participants were aged 25-80 years (mean 42.6 SD12.2) and non-autistic participants 25-79 years (mean 43.6 SD13.6). Over half (56.8%) of autistic respondents were female, 38.3% were male and 4.9% identified their gender as 'other'. The majority of non-autistic respondents (79.0%) were female.
The average length of visit to the general practitioner (GP) did not differ between autistic and non-autistic participants with the most commonly reported length of GP visit being 5-10 minutes (30%, 32%, respectively) and 10-15 minutes (33%, 35%, respectively). There were no differences in satisfaction with GP services between participant groups (p<0. 248) with more than 70% of both groups reporting they were satisfied or very satisfied. However when asked about the amount of help received from the GP, a larger proportion of autistic participants reported receiving ‘a little’ (21%) or ‘none at all’ (6%) in comparison to non-autistic participants (12%, 2% respectively) (p=0.033).
Autistic and non-autistic participants had different motivations to attend an appointment with a health professional (p<0.001). The majority (72%) of non-autistic participants attended a health professional because they wanted to go; compared to 57% of autistic participants. Twenty percent of autistic participants attended for both wanting to go themselves and being persuaded to go by someone else. Just over a third of autistic participants reported having delayed seeing a health professional for at least four weeks in comparison with only 15% of non-autistic participants. The reasons autistic participants delayed seeing a health professional included financial restraints, being unable to get an appointment and anxiety.
Conclusions: Generally, autistic and non-autistic adults reported similar lengths of GP visits and were satisfied with GP services in Australia. Less autistic adults attend a health professional because they want to and more autistic adults delay seeing a health professional due to a variety of reasons including anxiety. This study has important implications for the healthcare system in Australia.

38 **124.038** Impact of Anxiety and Autism Symptomatology on Pragmatic Language in Young Adult Males with Fragile X Syndrome

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Background: Fragile X syndrome (FXS) is the leading inherited genetic cause of autism spectrum disorder (ASD). It is also characterized by high rates of anxiety, with up to 84% meeting criteria for a disorder, resulting in reduced quality of life and increased impairment. It is speculated that anxiety interferes with language learning, particularly during social-interactive contexts resulting in pragmatic language (i.e., social language) impairments. Pragmatic impairments are highly associated with ASD, and investigation into the role of autism and anxiety in FXS on pragmatic language helps address the heterogeneity of behaviors and impairments based on a specific etiology.
Objectives: This is the first study to examine the effects of autism and anxiety symptoms on pragmatic language in young adult males with FXS using a semistructured, dynamic, conversational assessment. This study will identify specific language vulnerabilities in a syndromic, FXS population with high ASD comorbidity and will provide translational evidence for future treatment to optimize language development in males with FXS with findings relevant for different etiologic groups with ASD.
Methods: Participants included 25 young adult males (M_{age} 19.6, *SD* 2.1) with FXS. The Yale in Vivo Pragmatic Protocol (*YiPP*; Simmons, 2015) was administered to characterize use of appropriate pragmatic language and the level of contextual scaffolding from the examiner needed to elicit the target skill through error and cue scores. Error scores ranged from 0, appropriate spontaneous, to 2, completely inappropriate responses, and higher error scores are indicative of greater impairment. Cue scores ranged from 0, no response, to 6, spontaneous appropriate answer, and higher cue scores are indicative of better performance and less contextual scaffolding. Autism Diagnostic Observation Schedule-2 (ADOS-2) provided an autism severity index. Two subscales, socially avoidant and generalized anxiety, from the Anxiety, Depression and Mood Scale (ADAMS) assessed dimensional aspects of anxious behaviors to determine if deficits are related to generalized anxious states or isolated to social anxiety. Autism severity, generalized anxiety and socially avoidant behaviors were examined as predictors of language impairment.
Results: Â Participants had a mean error score of 1.44 (*SD* .39) reflecting language responses that tended to be mildly to completely inappropriate and cue scores of 2.41 (*SD* 1.30) indicating appropriate responses were elicited after greater scaffolding of conversational probes through nonspecific or specific verbal repetition or cues. Higher rates of social avoidance predicted greater language impairments (B=.04, *p*=.025, R^2=.48) and greater need for conversational scaffolding (B=-.11, *p*=.046, R^2=.47) after covarying for expressive vocabulary. Neither autism severity nor generalized anxiety symptoms predicted pragmatic impairments (*p*’s>.091) or contextual scaffolding (*p*’s>.159).
Conclusions: Â These findings highlight a complex relationship between anxiety and pragmatic language impairments in males with FXS. Results are consistent with a multifaceted interplay of dynamic systems involving language development in that socially avoidant behaviors, but not a pervasive anxious state, negatively impact pragmatic skills. Avoidant behaviors likely reduce environmental opportunities for learning, likely hindering social language development and augmenting avoidance. Continued research on the effects of autism and anxiety on pragmatic language is needed to comprehend similarities and differences across etiologies.

39 **124.039** Job Satisfaction and Quality of Life in Adults with Autism Spectrum Disorder (ASD) Participating in the Dandelion Program

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Background: Adults with Autism Spectrum Disorder (ASD) face disproportionately high rates of unemployment (Shattuck et al., 2012). Organizations can potentially improve employment rates in individuals with diverse needs by making reasonable adjustments and creating supportive environments in the workplace (Cavanagh et al., 2016; Yang & Konrad, 2011). When individuals are employed and experience job satisfaction this generally leads to positive outcomes, including improved quality of life (QoL). Job satisfaction predicts a range of positive outcomes including improved work performance, lower absenteeism, lower turnover, and higher overall life satisfaction (Judge & Klinger, 2008), but the research on job satisfaction among individuals with disabilities and/or ASD is sparse and has produced mixed results (Baumgartner et al., 2014).
Objectives: The present longitudinal study examined QoL and job satisfaction, as well as the relationship between these factors, in adults with ASD participating in the Dandelion Program. This program, an initiative of Hewlett Packard Enterprise (HPE), Australia, is a three-year traineeship providing a pathway into employment for people with ASD, with additional workplace supports to accommodate their diverse needs. Individuals are placed in information technology positions within the Australian Federal Government.
Methods: Participants were 20 males with ASD aged 20 to 45 years (M = 25.15, SD =7.74 years) who were employed as software testers by HPE and placed at two federal government locations in Australia. Participants completed the Minnesota Satisfaction Questionnaire, short-form (MSQ; Weiss, Dawis, England, & Lofquist, 1967), a widely reported job satisfaction questionnaire, and the World Health Organization Quality of Life-BREF (WHOQOL-BREF; WHO, 1996), at three time-points, corresponding to 6, 12, and 18 months of employment respectively. Data from co-workers were included for comparison purposes.
Results: General, intrinsic and extrinsic job satisfaction was higher than that of co-workers ($p < .05$), yet significantly decreased over time in participants with ASD. QoL of participants with ASD did not differ significantly from co-workers at the three time-points ($p > .05$), and remained stable over the 18-month period. We did not identify a significant association between job satisfaction and QoL ($p > .05$).
Conclusions: This study identified a relatively high but decreasing level of job satisfaction in adults with ASD employed as software testers in a supported employment program. This decrease was not reflected in a corresponding change in QoL, which remained stable over the same 18-month period. The lack of a significant relationship between quality of life and job satisfaction was unexpected – we predicted that satisfaction at work would be reflected in life satisfaction, as has been reported elsewhere in individuals with developmental disabilities (Noonan-Garcia, 2003). Similarly, we expected quality of life to improve over time, as has also been demonstrated previously in individuals employed in a supported work environment (García-Villamisar, Wehman, & Navarro, 2002), yet it did not. Further work is required to unpack the relationship between work and quality of life in working adults with ASD.

40 **124.040** Life after School: Understanding the Transition to Adulthood from the Perspectives of Young Autistic People and Their Parents

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Background: The majority of autism research focuses on understanding autism in childhood, which means that very little is known about the life chances of young autistic people as they transition into adulthood. The existing studies on this issue have consistently highlighted the striking variability in long-term outcomes of autistic individuals, even in individuals considered to be cognitively able. But the measures used to index a 'good outcome' are often quite crude in nature (e.g., proportion of individuals living independently, in paid employment etc.). Rarely has research sought to examine what a good outcome means from the perspectives of the individuals themselves or the people that support them.
Objectives: This study sought to understand the views and experiences of transition in a group of cognitively able young autistic people on the cusp of adulthood.
Methods: Twenty-eight cognitively able young autistic people took part in a 12-year prospective longitudinal study. In addition to standardized instruments, we conducted semi-structured interviews with 26 young people (M age = 17 years; 10 months; SD = 1;2) and 28 of their parents to elicit their views and experiences of school and their hopes and aspirations for their future lives. Thematic analysis was used to identify key themes.
Results: We identified three themes common to both young people and their parents' interviews, including (1) challenges that young autistic people face during this period of their lives, (2) autism and "autistic" identity, and (3) factors facilitating positive outcomes. Parents highlighted several concerns, including about anxiety, difficulties with organization, problems with motivation and potential vulnerability. Parents also expressed considerable concerns about lack of friends and romantic relationships. The young people themselves were less worried about not having friends, as many were often keen to keep to themselves. Nevertheless, they all had clear ambitions and appeared to have an age-appropriate desire for increased independence. Indeed, many astutely noted the importance of "getting the right amount of support" – that is, the need to strike a balance between providing support and building capacity for being able to manage flexibly in a variety of contexts, especially important for life after school. Young people varied considerably, however, with regard to their views on being autistic and the role it had to play in their lives, with some identifying it as a challenge, others distancing themselves from the diagnosis ("I try to be as normal as possible") and others still seeing it as a positive difference. There was agreement between parents and young people that "likeability", strengths and interests and a drive to reach goals were key factors in promoting young people's outcomes.
Conclusions: These findings shed light on the challenges faced by cognitively able young autistic people as they move on up into adulthood, especially the pressures – including from their parents – to conform to societal norms. The results further highlight the need to establish the most effective ways to prepare young autistic people for the potential obstacles they face as they make the transition to adulthood.

41 **124.041** Lifelong Learning in Autism: A Life History of an Autistic Woman's Learning Journey in Formal and Informal Learning Contexts

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Background: Learning in autism remains underexplored in the literature and little is known about the lifelong learning experiences of adults on the spectrum or ways in which adult education can be inclusively designed to support and promote success. What we do know about learning in autism is that learning is atypical. Additionally, there is also resistance to learning in typical ways from typical approaches and therefore, a non-normocentric approach to evaluating and teaching autistic people is recommended. As incidence rates of autism diagnosis increase across society, more adults diagnosed with ASDs are enrolled in adult education. As such, this study seeks to richly describe the lived experience of one adult learner with autism and discover themes that suggest directions for autism-inclusive adult education design.
Objectives: The purpose of this study is to understand what lifelong learning looks like for an individual with autism. By exploring the life story of one elderly autistic woman, the barriers and facilitators to learning across the lifespan of an individual with ASD are revealed. Four sub-questions are examined: 1. How is learning for people with autism parallel to, different from, and complementary to non-autistic learning? 2. How does formal and informal learning occur? 3. What does this tell us about the transformative potential of self-directed learning for adults with autism? 4. What are some of the facilitators and barriers to learning?
Methods: The study used a qualitative life-history methodolgy. The life-history was established through a series of narrative interviews. The narratives collected and composed in this study were analysed using thematic analysis.
Results: This study examines the life history of a 72-year-old Deaf woman with an autism. By analysing her life experiences and narrative, questions of identity- and ability-diversity are highlighted and barriers and facilitators to learning and inclusion are discovered. The participant's story highlights the complex interrelationship between learning, identity, neurodiversity, legitimacy and agency, and the mediating roles of inclusion and accessibility. The findings contribute to developing a deeper understanding of the meaning and importance of formal and informal learning in the life of a person with autism and indicate ways in which the learning of adults with ASDs can be supported and enhanced.
Conclusions: Â Learning for the participant, across her lifespan, can be characterized as profoundly atypical from both a developmental and educational perspective. Her learning trajectory does not map easily onto a non-autistic learning history. Her story is rich from an educational biography perspective, giving voice to an exceptional person's life experience within a specific historical context. Her story strongly suggests the importance of using a non-normocentric approach that appreciates the unique and complimentary strengths, skills, and needs of adult learners on the autism spectrum. Her descriptions of learning demonstrate that she learns from often atypical types and sources of information and has a preference for self-education. Her story also powerfully highlights the importance of self-determination and the transformative potential of self-direction for learners like her and emphasizes the potential impact of leveraging technology to support learning, communication, engagement and autonomy.

42 **124.042** Loneliness and Quality of Life for the Broader Autism Phenotype

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Background:
Autism-related traits vary along a wide severity continuum, including subclinical traits that are continuously distributed among the general population (commonly referred to as the broader autism phenotype; BAP). Recognition of the BAP has led to increased interest in how these milder autism characteristics may influence functional outcomes in nonclinical populations. A small body of research has found that the BAP is related to fewer and lower-quality interpersonal relationships, as well as increased loneliness. This study investigated specific associations between the BAP and relationship quality and outcomes. Clarifying these associations is critical for identifying factors impacting quality of life in individuals with both subclinical and clinically significant symptoms of autism.
Objectives:
(1) Compare loneliness, distress, quality of life, relationship status, and social support among college students with and without BAP traits. (2) For the BAP group, investigate whether loneliness is associated with negative mental and physical health outcomes, and whether it accounts for a relationship between BAP traits and lower quality of life. (3) Test whether quantity and quality of relationships influences the impact of BAP traits on loneliness.
Methods:
Participants were 736 students (18-30 years, M=20.9, 65% female, 44% in a relationship) at the University of Utah. Participants completed the Broader Autism Phenotype Questionnaire (subscales: aloofness, pragmatic language, rigidity), the UCLA Loneliness Scale, the Depression Anxiety and Stress Scale, the MOS Social Support Survey, and the WHO Quality of Life-Bref (subscales: physical health, psychological, social, and environmental).
Results:
Individuals who met criteria for BAP (n = 95) rated themselves as experiencing more loneliness (p<.001) than their non-BAP peers. Additionally, the BAP group reported higher levels of stress, depression, and anxiety (p's<.001), and poorer quality of life across all domains (p's<.001). Within the BAP group, greater loneliness was correlated with increased stress (p=.001), depression (p=.001), and anxiety (p=.036). Furthermore, loneliness mediated the relationship between BAP and quality of life (p<.001). The BAP group was as likely as the non-BAP group to report a current romantic relationship (p=.473), yet reported lower overall levels of social support (p=.001). Both number of significant relationships and the perceived social support provided by those relationships were predictors of loneliness (p's<.001) within the BAP group. Of the BAPQ subscales, aloofness uniquely predicted loneliness within the BAP group, including when controlling for relationship status and gender.
Conclusions:
Individuals with subclinical autism-related traits are more likely to experience loneliness, resulting in poorer health outcomes and perceived quality of life. Quality of significant relationships predicts levels of loneliness in individuals with BAP. Additionally, the BAP trait of aloofness appears to be specifically related to loneliness. Together, these findings indicate that people with subclinical autism symptoms experience difficulty with relationships, and this difficulty is reflected in their health and quality of life. The importance of supporting healthy relationships is underscored for individuals across the autism spectrum.

43 **124.043** Measuring Work Adjustment in Adolescents with ASD

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Background: Adults with ASD often have poor outcomes including difficulty gaining and keeping employment. Research shows the current employment rate for young adults with ASD is 35% (Roux et al. 2013). Because employment is a pivotal experience that typically leads to better daily living skills (Taylor et al., 2015) and higher quality of life (Klinger et al., 2015), it is important to develop instruments that assess individuals' workplace readiness skills to identify individualized intervention goals. A common brief (i.e., 15 minutes) Vocational Rehabilitation assessment measure is the Becker Work Adjustment Profile (BWAP). The BWAP is composed of four subscales: Work Habits, Interpersonal Relations, Cognitive Skills, and Work Performance. It has been validated for persons with a wide variety of physical, developmental, and psychiatric disabilities but has not been previously validated with adults on the autism spectrum.
Objectives: The goal of this study was to examine the validity of the BWAP for adults with ASD. Specifically, we examined the relation between the BWAP and other measures associated with employment outcomes in adults with ASD: ASD symptom severity, intellectual functioning, and executive functioning.
Methods: Participants were 42 adolescents with ASD (14-19 years of age, M = 16 years,10 months) who participated in an employment and college readiness intervention. Measures were collected during a baseline assessment prior to beginning the intervention. All participants had their diagnosis confirmed by the ADOS-2, and all had intellectual functioning within the average range on the Wechsler Abbreviated Scale of Intelligence-II (WASI-II; range: 85-135; M=104). Parents completed the BWAP, the Social Responsiveness Scale-2 (SRS-2), and the Behavior Rating Inventory of Executive Functioning Adult Version (BRIEF-A). Teachers also completed the BWAP.
Results: Parent and teacher BWAP total scores were highly correlated (r=.65, p<.001) supporting convergent validity across raters. Multiple regression analyses were conducted to investigate the relation of each BWAP subscale to ASD symptom severity (SRS-2), intellectual functioning (WASI-II), and executive functioning (BRIEF-Global Executive Composite). For parent completed BWAP, Work Habits and Work Performance were significantly predicted by the BRIEF-GEC (β=-.71, p<.001 and β=-.78, p<.001, respectively). BWAP Interpersonal Relations was predicted by SRS-2 (β=-.37, p=.02) and BRIEF-GEC (β=-.32, p=.04). Finally, BWAP Cognitive Skills was predicted by WASI-II (β=+.48, p=.001) and SRS-2 (β=-.44, p=.001). Similar results were seen for the teacher completed BWAP.
Conclusions: Each of the subscales of the BWAP was strongly related to measures of functioning in adolescents with ASD. BWAP Interpersonal Relations was strongly related to autism symptom severity, BWAP Cognitive Skill was strongly related to intellectual functioning, and BWAP Work Habits and Work Performance was strongly related to executive functioning. These results suggest that the BWAP provides a relatively brief measure of employment skills that capture the range of interpersonal, intellectual functioning, and executive functioning difficulties experienced by adults with ASD in work settings. Research examining the utility of this measure in documenting intervention effectiveness is ongoing.

44 **124.044** Money Matters: Risks of Limited Money Understanding Among Adults with ASD

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Background:
Money management is a unique adulthood need for some individuals with ASD. Money appears to be a difficult concept for many adults with ASD to understand and manage with extensive consequences of incompetence, and yet it remains largely unrecognised on the evidence base of supportive services. Patterns of money spending and financial management of adults with ASD including impulsive spending, poor planning, and obsessive saving and monitoring of money may be associated with repetitive patterns of behaviour characteristic of autism, executive function deficits and mental health comorbidities. However, individual personalities, experiences and media influences may also contribute to financial habits with learned money skills and changes in monetary patterns possible with effective support. Currently, informal support efforts from family members may be meeting the financial and money management needs of adults with ASD. Formal support services may be essential when family support is unavailable. Limited understanding of money and the inability to manage it may place adults with ASD at risk of harm.
Objectives:
To explore the monetary competencies and financial patterns of behaviour of adults with ASD.
Methods:
Using mixed methods, 74 adults with ASD (19-65 years of age), recruited from a London clinic, completed the Camberwell Assessment of Need for Adults with Developmental and Intellectual Disabilities (CANDID) and 49 family members participated in semi-structured, face-to-face interviews to explore the capabilities and support needs of adults with ASD. SPSS was used to analyse quantitative data and thematic analysis conducted with qualitative information.
Results:
Money budgeting difficulties were reported by adults with ASD as a high and unmet need on the CANDID, and monetary limitations and consequences were widely expressed and described in interviews. Problems with financial literacy and skills ranged from basic understanding of the monetary value of paper money and coins, difficulty with maths and counting change, to the inability to accomplish routine tasks of bill paying, to complex tasks such as budgeting and banking. Money management difficulties included the inability to budget or pay bills, over or underspending, lending or giving money away, and difficulty understanding credit cards and money. Some adults with ASD had experienced financial abuse and exploitation. Many had their money and spending monitored or managed by family members. The inability to think ahead, or to anticipate future needs, and difficulties in prioritising and decision-making, were key concerns of family members for adults with ASD who had some control over their finances. The need for financial support and money management, particularly with reference to the future, was frequently stated by, and about adults with ASD. However, who would assume this responsibility, family or formal support services was vague.
Conclusions:
Limitations in financial understanding may impede adults with ASD from making decisions as informed consumers, and place them at risk of harm and exploitation without adequate and effective support. An unmet need in the area of money management may significantly impact the safety and wellbeing of an adult with ASD.

45 **124.045** Mortality and Cause of Death in People on the Autism Spectrum: An Exploration of State-Based Administrative Data.

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Background:
Examination of mortality and cause of death is of central importance for understanding the extent and nature of health inequalities for adults with autism spectrum disorder (ASD). Previous studies indicate that this population experiences 2 to 5.6 times higher mortality rates than the general population. Whilst respiratory disease and nervous system disorders are leading causes of death, unnatural and avoidable events, such as accidents and suicide, are also notable causes. In addition to the general paucity of information regarding health and wellbeing outcomes for adults on the autism spectrum, there has been limited investigation of mortality and cause of death.
Research concerning mortality and cause of death is of key importance for the evaluation and planning of health services and policy. Robust analysis of large linked data sets provides representative and timely information for such evaluation and planning.
Objectives:
To examine mortality rates and cause of death for adults with ASD, intellectual disability and both in comparison to the general population in New South Wales (NSW), Australia.
Methods:
Nine NSW state-based retrospective datasets have been linked as part of a larger project exploring the health and wellbeing of people with intellectual disabilities. These datasets cover the period of 2005/06 to 2011/12. We expect to have extended datasets (up to 2015/16) available for analysis and presentation by early 2017. For the current study, the ASD cohort was identified primarily through the Disability Services Minimum Dataset. Mortality and cause of death data were obtained from the NSW Attorney General and Justice Register of Births, Deaths and Marriages (RBDM) and from the Australian Bureau of Statistics (ABS). Population size, mortality and cause of death in the general population in NSW were accessed via the ABS data.
We will compare data for four groups: (i) ASD only, (ii) intellectual disability only, (iii) ASD and intellectual disability; and (iv) the general population in NSW. Descriptive statistics will be used to describe causes of death. Other analyses will include age-specific crude death rates, standardised mortality rates and Comparative Mortality Figure (CMF) and years of potential life lost (YPLL).
Results:
In our existing data n=15,983 adults with ASD only, n=42,243 adults with intellectual disability only, and n=7,497 adults with both ASD and intellectual disability were identified to have accessed disability services in NSW between 2005/06-2011/12. We anticipate that for the extended dataset, this cohort will increase substantially (at least n=20,000 adults with ASD only, n=60,000 adults with ID only and n=10,000 adults with both ASD and intellectual disability).
Conclusions:
This study will provide the most reliable and current information on mortality and cause of death in adults on the autism spectrum in Australia. Due to the nature of the data, it will include a wider sample of individuals on the autism spectrum than any other Australian study. This information will be of intense interest to health professionals, service providers and families, and will help shape efforts to address premature death for this population.

46 **124.046** New Age Vocational Training Program for Adults with Autism: Integration of Soft Skills Training and Software Testing

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Background:
Longitudinal studies of intellectually able adults with autism have shown consistent and persistent deficits across cognitive, social, and vocational domains, indicating a significant need for effective treatments for these functional disabilities (Howlin, 2000). The cognitive and social skill deficits, "Soft Skills" which predict vocational outcomes, have been identified as major challenges to employment success for these adults (Hillier et al, 2007; Kautz et al, 2014). Additionally, individuals with AS gravitate to technology fields more than general population (Wei et al, 2013), providing a well-suited career choice.
Objectives:
This study tested a novel, community-based intervention that combines a soft skills manualized intervention, **Su**pported employment, **C**omprehensive **C**ognitive **E**nhancement & **S**ocial **S**kills (SUCCESS) with a software testing training program for adults with ASD. An open trial pilot study was conducted to obtain estimates of effects of multiple outcomes: cognitive skills, social skills, technical skills, vocational skills and satisfaction.
Methods:
A total of 25 adults (μ= 24 SD=4.64 yrs) participated and received the combined SUCCESS & Technical Skills program. Participants participated in the program 3 days a week for 3 hours each day totaling 9 hours a week over 6 months. The SUCCESS curriculum was delivered weekly for 90minutes via active group participation during a work meeting. Skills taught include executive functioning: attention, learning, memory, prospective memory, cognitive flexibility, problem solving, goal oriented thinking and contextual awareness and social cognition: social conversation (giving and receiving compliments, feedback and help), social relationships, initiations, social media and social networking. The technical skills curriculum prepares the participant for a position as an entry level Software QA Tester in the high tech industry, and also prepares the student to obtain a Certificate in Software Testing (from ISTQB). Pre and post assessments include a full battery of assessments with the Behavior Rating Inventory of Executive Function- Adult Version (BRIEF-A) ,Social Responsiveness Scale-2 (SRS-2), technical skills performance (completion rates, accuracy of bug detection, program proficiency), work skills (attendance, dress code, productivity) and vocational outcomes (employment). Data was gathered from standardized measures (participant and parent report), records, computer program reports and program staff ratings. The majority of participants were male (90%), white race/ethnicity (84%) and all graduated with a high school diploma.
Results:
Analyses consisted of calculating paired sample t-tests and Cohen's d effect sizes to measure the magnitude of the effect of the intervention on outcomes. Preliminary findings reveal small to large effects on executive functioning and social functioning (Refer to Table 1 & 2). Reports of tech skills and work skills revealed large gains. Employment rates increased from 20% to over 50% post intervention. Program satisfaction was very high with mean rating of 8.9 out of 10.
Conclusions:
This study demonstrates that an integrated program designed to develop technical skills and vocational soft skills positively impacts adults with ASD. These adults were substantially more prepared for the workforce and obtained employment at high rates. This job-training program revealed high satisfaction and promise towards vocational success for adults with ASD.

47 **124.047** Parent Preparatory Activities As Adolescents with ASD Transition to Adulthood

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Background:
Extant longitudinal research suggests parental expectations during adolescence are a significant predictor of outcomes in the areas of social participation, employment, and independenceÂ for adults with autism spectrum disorder (ASD). Parental expectations around sexuality in ASD populations have also been shown to predict parental actions (i.e., the provision of sex education).Â Thus, it is hypothesized that parents' selection of adulthood preparation activities during adolescence may serve as one mechanism through which parent expectations contribute to outcomes for adults with ASD.
Objectives:
1. Examine gender and cognitive level differences in the preparation activities endorsed by parents of youth with ASD.
2. Determine if gender, cognitive level, age, and parental expectations for the future predict parent-endorsed preparation activities.
Methods:
A national sample of 309 parents of 12–18 year-olds (M=14.4) with ASD (52% male; IQ estimates: 67% average or above, 13% borderline, 21% IQ <70) provided information about youth age, estimated IQ, autism severity (SRS-2), and parental expectations for the future regarding education, financial independence, community roles, and sex/romance (rated 1-5; very unlikely to very likely). Parents also endorsed actions taken to support development in the areas of sexuality/relationships and employment/independence. We grouped similar actions (e.g., enrolled child in a class to build skills, provided education, youth participated in paid or volunteer work) and created binary variables indicating whether any action in the category was endorsed. Chi-square tests and logistic regression were applied to address the objectives.
Results:
Parents of males were more likely to seek guidance from professionals about sex and relationships, talk to their child about jobs, and to have their child participating in paid or volunteer work. Parents of females were more likely to enroll their child in a class to build skills. Youth with IQ<70 were less likely to receive education related to sexuality/relationships and employment/independence.
Conclusions:
Because of the balanced inclusion of males and females, this study offers a unique look at gender differences in parent-endorsed preparation activities during adolescence. The finding that males are more likely to engage in activities in the community while females are more likely to participate in formal classes suggests there may be more concern about protection of daughters with ASD. It is noteworthy that parent actions were similar for youth in the two higher cognitive categories considering that prior studies report outcomes are similar across the range of adults with ASD without intellectual disability. Finally, this study provides evidence to support the hypothesis that the actions parents take to support their child's transition to adulthood are informed by their expectations and may serve as a mechanism through which expectations predict outcomes.

48 **124.048** Participation in Recreational Activities Buffers the Impact of Perceived Stress on Quality of Life in Adults with Autism Spectrum Disorder

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Background: As the number of adults with autism spectrum disorder (ASD) grows, the need to identify modifiable correlates of positive outcomes and quality of life (QoL) gains in importance. Research indicates that perceived stress is significantly correlated with QoL in adults with ASD. Studies in the general population of individuals without disabilities indicate that greater participation in social and recreational activities may lessen the negative impact of perceived stress on well-being, and this association may also hold among adults with ASD.
Objectives: Our objectives were to: (1) examine the association between perceived stress and QoL; and (2) explore the moderating effect of participation in social activities and recreational activities on the association between perceived stress and QoL.
Methods: Data to address our hypotheses were collected prospectively from 60 adults with ASD aged 24-55 and their mothers who were part of a large, longitudinal study of 406 adolescents and adults with ASD and their families. Measures assessed perceived stress (Perceived Stress Scale), QoL (brief version of the World Health Organization Quality of Life assessment), and self- and mother-reported social activities and recreational activities. Hierarchical multiple linear regression analyses first explored the buffering role of self-reported social activities and recreational activities on the association between perceived stress and QoL. Then, follow-up analyses used the same technique to investigate the impact of mother-reported social activities and recreational activities on the association between perceived stress and QoL.
Results: Overall, adults with ASD reported that they participated in slightly less than one social activity (*M=0.82, SD=0.90*) and about three recreational activities (*M=2.98, SD=.89*) per week, and mother-report data independently confirmed these patterns. Results of hierarchical multiple regression analyses revealed a significant, positive main effect of perceived stress on QoL, *B=-8.07, t(53)=-3.77, p<.01, sr^2=.18*, when controlling for age, sex, and ID status. Results revealed that recreational activities buffered the relationship between perceived stress and QoL, *B=5.88, t(51)=2.49, p=.02, sr^2=.07*, such that for individuals with higher levels of participation in recreational activities, the negative effect of perceived stress on QoL was lessened. Our findings related to mother-reported social activities and recreational activities mirrored our adult self-report findings.
Conclusions: Findings corroborate a growing body of literature that indicates that high perceived stress is a problem for a sub-group of adults with ASD that needs to be addressed through targeted treatment. Our findings also suggest that interventions and services that provide supports and opportunities for participation in recreational activities may help adults with ASD manage their stress and lead to better QoL. Of note, much of the ASD literature suggests that interventions should target core autism symptoms in order to help individuals with ASD to develop social networks. However, participation in social activities was not associated with QoL in our analysis. Thus, interventions that offer opportunities for participation in recreational activities, even if those activities do not provide explicit opportunities for socialization, may help adults with ASD manage their stress and, in turn, feel more satisfied with their QoL.

49 **124.049** Poor Initiation and Planning Abilities in Young People with Autistic Traits

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Background: The investigation of autistic traits in the "typically developing" population has shown that people with sub-threshold behavioural autistic traits perform poorer on some executive functions. However, little is known about how these traits relate to problems in executive functions using ecological measures.
Objectives: Â The present study examined whether young adults with autistic traits experience increased executive functions difficulties in their everyday life.
Methods: SeventyÂ young adults (18-30 years old) were administered the Autism Spectrum Quotient (AQ), and designated as high autistic traits (n=26) or low autistic traits (n=44). The Behavior Rating Inventory of Executive Function (BRIEF-A) was used to evaluate executive function.
Results: Individuals with higher autistic traits reported having more difficulties than the low autistic traits group in the BRIEF-A self-report in two scales: Initiate (p<0.05) and Planning (p<0.01).
Conclusions: Problems with initiation, the ability to begin an activity, and planning, the ability to anticipate future and implement goals, have been consistently reported in individuals with autism spectrum disorder. These results show that "typically developing" population with high autistic traits also experience difficulties in these two abilities.These findings call for further research on the relationship between autistic trait and executive functions, particularly with respect to underlying mechanisms that might mediate this association.

50 **124.050** Rates of Autism Spectrum Disorder in Adults with Prader-Willi Syndrome

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Background: Prader-Willi Syndrome (PWS) is a neurodevelopmental disorder caused by a lack of paternally derived imprinted genes on chromosome 15q11-q13. It is associated with mild to moderate intellectual disability, irritability, outbursts, rigid behavior, and hyperphagia which increases risk for obesity. Those with PWS have an increased risk for psychiatric issues such as anxiety, attention deficit disorders, psychosis and autism spectrum disorder (ASD). However, there are methodological concerns about the rates of ASD in PWS as most research in this area has relied upon autism screeners or checklists instead of direct assessments combined with clinical reviews to establish ASD diagnoses. Previous studies also typically include a wide age range, introducing potential age effects and observer memory bias. Finally, the nature of repetitive behaviors in PWS may inflate or complicate ASD diagnoses.
Objectives: This study addresses methodological concerns with ASD comorbidity in well-characterized adults with PWS.
Methods: Participants included 42 adults (19 male, 23 female) with PWS ranging in age from 22 to 55 years (M = 30.41 years, SD= 8.21). The Autism Diagnostic Observation Schedule (ADOS-2) Module 3 and Social Communication Questionnaire (SCQ) were used as two ASD assessments, with ASD diagnosis determined by clinician consensus and review of pertinent data. Each participant was also administered the Kaufman Brief Intelligence Test-2 (KBIT-2), the Vineland Adaptive Behavior Scales-II, and the Repetitive Behavior Scale-Revised (RBS-R).
Results: 20 adults (47.6%) were identified as meeting ASD criteria based upon the recommended SCQ cutoff score of >15. 13 adults (30.9%) were identified as meeting autism spectrum criteria using ADOS-2 calibrated severity scores. In contrast, only 4 adults (9.5%) received an autism diagnosis when ADOS-2 data, videos, and other behavioral data were subjected to a thorough clinical review. 3 out of these 4 were of the maternal uniparental disomy (mUPD) genetic subtype of PWS. For the group as a whole, no significant correlations were found between ADOS-2 scores and gender, age, RBS-R or KBIT-2 scores. Moderate negative correlations were found between Vineland's Communication, Daily Living Skills, and Socialization domain scores and ADOS-2 Overall Calibrated Severity Scores (r = -.49, -.63, -.44 respectively, p < .01) and Social Affect Severity Scores (r = -.44, -.57, -.35 respectively, p < .05).
Conclusions: Both the SCQ and ADOS-2 alone suggested more than twice of the sample met ASD criteria as compared to diagnoses made using a review of data and clinical consensus. Future studies should not rely on ASD screeners alone to establish probable ASD in PWS. Most adults with PWS and ASD had the mUPD genetic subtype of PWS.

51 **124.051** Ratings of Social Functioning and Participation in Employment and Postsecondary Education Among Adults with Autism and Schizophrenia

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Background: Interpersonal skills are critical to success in meeting the demands of adulthood, including participation in continued education or employment. Social impairment is a core deficit of autism spectrum disorder (ASD) and an associated feature of schizophrenia (SZ) that may contribute to difficulties attaining successful adult outcomes. Adolescents with ASD tend to have more positively biased self-perception of their interpersonal self-efficacy than their typically developing peers, but little is known about the self-perception of adults with ASD. Findings regarding self-awareness among individuals with schizophrenia indicate that awareness of the illness along with minimal internalized stigma are related to improved social functioning. Thus, self-perception of one's skills may be an important factor in predicting adult outcomes.
Objectives: This study aims to investigate: 1) the relationship between subjective self-perception of social functioning and clinician-rated levels of social functioning and 2) the relationship between these indicators and participation in postsecondary education and/or employment in adults with ASD, SZ, and typical controls.
Methods: The sample for this study comprises 18 adults with ASD (15 males, 3 females; Mean age=24.6), 18 individuals with schizophrenia (14 males, 4 females; Mean age=28.0) and 6 neurotypical adults (4 males, 2 females; Mean age=25.8); data collection is ongoing. The ASD and the SZ groups were matched on age and IQ (*WASI-II* FSIQ), and all three groups were matched on age and nonverbal IQ (*WASI*-II PRI). Subjective self-perception of social functioning was assessed using the Social Communication Interaction (SCI) Total score of the *Social Responsiveness Scale- Second Edition – Adult Self-Report* form (SRS-2). Clinician-rated levels of social functioning were measured using the *ADOS-2, Module 4*Social Affect Algorithm Total score. Information regarding school and employment status was obtained during the ADOS-2 assessment.
Results: Both ASD [$F(1,22) = 7.05$, $p<.001$] and SZ [$F(1,22) = 6.08$, $p=.02$] groups reported greater deficits in social interaction than typical controls. A negative correlation between self and clinician rating of functioning was observed in the ASD group [$r = -.61$, $p=.007$] but not the SZ group. Additionally, a significant relationship between self-perceived severity of social impairment and participation in school/employment was found for the SZ group [$X^2(3, N = 18) = 9.36$, $p<.05$], such that decreased school/employment participation was associated with increased levels of self-reported social impairment. Self-reported social ability and school/employment outcomes were not associated for the ASD participants. No significant relationship between clinician ratings of social functioning and school/employment participation was observed in either group.
Conclusions: The present findings add to our understanding of self-perception and social functioning of adults with ASD and schizophrenia. While self-reported social impairment appears related to employment/school outcomes in individuals with SZ, no relationship was found for the ASD group suggesting that adults with ASD may have decreased insight into how their social impairment affects their employment/school outcomes.

52 **124.052** Relating ASD Symptoms to Well-Being: Moving Across Different Construct Levels

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Background:
Little is known about the specific factors that contribute to well-being of individuals with autism spectrum disorder (ASD). A plausible hypothesis is that ASD symptomatology has a direct negative effect on well-being. Past studies investigating the interacting nature of ASD symptoms and well-being have often included higher order representations of ASD symptomatology in their analyses. In the current study, the emerging tools of network analysis allow to explore these functional interdependencies in a multivariate framework. We illustrate how studying both higher-order (total score) and lower-order (subscale) representations of ASD symptomatology can provide important insights into the interrelations of factors relevant to well-being.
Objectives:
We aim to study the interplay of ASD symptoms and domains of subjective well-being and daily functioning on three construct levels by applying network analysis techniques in an exploratory fashion.
Methods:
We estimated network structures for ASD symptomatology (item, subscale, total score), relating them to daily functioning and subjective well-being in 323 individuals with ASD (aged 17 to 70 years). For these networks, we calculated centrality indices to assess the importance of specific factors in the network structure.
Results:
First, results of our total score network reveal that ASD symptom severity has a direct influence on psychological well-being, which is, in turn, the most important factor for general life satisfaction of individuals with ASD. Second, the relation between depressed mood and ASD symptoms seems to be not a direct influence but funneled by many other domains of daily functioning. Third, the resulting networks do not feature a direct mutual influence between ASD symptom severity and comorbid problems.
Conclusions:
When focusing on the highest representation level of ASD symptomatology, we found a negative connection between ASD symptom severity and domains of well-being. However, focusing on lower representation levels of ASD symptomatology revealed that this connection was mainly funneled by ASD symptoms related to insistence on sameness and experiencing reduced contact and that those symptom scales, in turn, impact different domains of well-being. Zooming in across construct levels into subscales of ASD symptoms can provide us with important insights on how specific domains of ASD relate to specific domains of daily functioning and well-being.

53 **124.053** Relationship of Executive Functioning Deficits and Life Outcome in Intellectually Able Adults with ASD

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Background: Â
Intellectually able persons with high-functioning autism spectrum disorders (ASD) often have difficulty with independent living and successful transition into adulthood. In addition to the social deficits of ASD, many experience deficits in executive functioning which may impede adaptive functioning, goal attainment, employment success, independent living, and achieving educational goals.
The Barkley Deficits in Executive Functioning Scale (BDEFS-LF) is a self-report assessment used to evaluate adults ages 18 to 81, and measures type and extent of EF deficits. Because it incorporates a long-term view of a person's executive functioning, the BDEFS-LF may be helpful for understanding where specific areas of difficulty correlate with life functioning.
Objectives: Â
This study is designed to investigate relationships between executive functioning deficits and life outcomes in intellectually-able adults who meet DSM-IV/DSM-5 criteria for ASD. A primary objective of this study is to provide evidence of BDEFS-LF score patterns linked to life outcome for intellectually able adults with ASD which can then be used for clinical application.
Methods: Â
Data were collected from archival records of intellectually able adults who qualify for a DSM-IV or DSM-5 diagnosis of Autism Spectrum Disorder (Asperger's Type) from an outpatient clinic which specializes in diagnosing ASD in adults. There were 43 participants with DSM-IV/DSM-5 ASD (40% F). Distribution of ages was 37% in the 18 -25 year-old category, 42% age 25-39, 20% over the age of 39. Specific records studied include scores from BDEFS-LF categories of self-management to time, organization and problem solving, self-restraint, self-motivation, and self-regulation. Independent variables were: Relationship Status, Education, Employment, and Residence.
Results:
Standard linear regression was conducted to determine the accuracy of the independent variables (BDEFS-LF scores for self-management to time, organization and problem solving, self-restraint, self-motivation, and self-regulation) in predicting the dependent variables of relationship status, education, employment, and place of residence.
Regression results indicate that the overall model significantly predicts current marital status and residence. Results for marital status are (R^2 = .144, $R2_{adj}$ = -.028, F(5, 37) = 1.244, p<.05), which accounts for 14.4% of variance. One of the four variables, self-management to time, significantly contributed to the model. The overall model also significantly predicts residence (R^2 = .209, $R2_{adj}$ = -.102, F(5, 37) = .1.957, p<.05). This model accounts for 20.9% of variance in the dependent variable of residence. As with the results for marital status, the variable of self-management to time significantly contributed to the model. However, regression results indicate the overall model does not significantly predict employment status or level of education.
Conclusions:
Results suggest the factor of self-management to time significantly impacts marital status and independent living for intellectually able adults with ASD. This preliminary investigation into specific executive functioning components which might benefit from clinical treatment suggests that focusing on time management skills might assist with growing skills for independence, particularly maintaining adult relationships and independent residence. Limitations include size of study and the preliminary nature of the investigation. Future directions are underway as data continues to be collected, and may include gender differentials.

54 **124.054** Sexual Orientation in High-Functioning Individuals with Autism Spectrum Disorder

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Background:
Clinical impressions indicate a sexual profile within the Autism Spectrum Disorder (ASD) population unlike that seen in the general population that is suggestive of a wide range of sexual orientations. However, little is presently known about the demographics of sexual orientation in ASD.
Objectives:
We hypothesized that there would be an increased prevalence of non-heterosexual orientations within the ASD population.
Methods:
We surveyed sexual orientations with the Sell Scale of Sexual Orientation in an international sample of individuals with ASD (*N*= 309, *M*=90, *F*= 219), aged (*M*=32.30 years, *SD*=11.93) and compared these rates to those of typically-developing individuals (*N*=310, *M*= 84, *F*= 226), aged (*M*=29.82 years, *SD*=11.85). We also compared qualitative responses using thematic analysis, related to sexuality-related attitudes of 109 individuals with ASD (41 males, 68 females) with 70 TD individuals (36 males, 34 females).
Results:
When compared to TD individuals, individuals with ASD demonstrated significantly higher sexual diversity (χ^2= 45.85, p< 0.001, φ=0.39), and this diversity was greater among females than males with ASD. The ASD group reported higher rates of homosexuality (males OR= 2.53, p< .05; females OR= 1.87, p=.06), and asexuality (males OR= 4.18, p< .05; females OR= 2.58, p< .001), but lower rates of heterosexuality (males OR= 0.25, p< .001; females OR= 0.45, p< .01).Â Findings from the qualitative study demonstrated that relative to TD individuals, individuals with ASD reported the birth-sex of their romantic partner as being less important (χ^2= 52.48, p< 0.001, φ=0.56), more discontentment with their own sexual orientation, which was likely to fluctuate based on life-experiences (χ^2= 69.66, p< 0.001, φ=0.65), and were more approving of non-heterosexuality (χ^2= 15.34, p< 0.001, φ=0.30). The ASD group reported poorer mental health than controls and belonging to a non-heterosexual group worsened this effect.
Conclusions:
Results suggest that ASD presents unique challenges to the formation and consolidation of sexual identity. It is important that clinicians working with ASD are aware of the sexual diversity in this population, so that the necessary support for healthy socio-sexual functioning and mental well-being is provided.

55 **124.055** Social Cognition in Old Adults with Autism Spectrum Disorder (ASD): A Potential Age-Related Protective Effect

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Background: Although ASD is a life-long condition and most individuals with ASD are adults, there is little research about ageing in autism. Difficulties with social cognition have been repeatedly demonstrated in children, adolescents and young adults with ASD, but only a handful of studies have included individuals aged 50 years or over . It has been widely documented that social cognition gets worse with age in the neurotypical ageing population (perhaps secondary to changes in e.g., memory); however, we still do not know how age affects social cognition in older adults with autism.
Objectives: To gather more information about the pattern of social cognition in older versus younger adults with ASD compared to neurotypical (NT) adults, we investigated social cognition performance on a number of different tasks tapping Theory of mind and social cognition more generally. These included a novel cartoon sequencing task designed to be low in working memory load.
Methods: Performance on a set of social cognition tasks was examined in a group of adults with ASD (N=58; age-range: 19-71 years, M_{age} = 43.66 years, SD = 16.11) compared to an IQ-, gender-, and age-matched NT control group (N=49, age-range: 20-71 years, M_{age} = 44.95, SD = 17.54). Group comparisons between younger (N=49, aged 19 to 48, M_{age} = 29.45 years) and older adults (N=48, aged 50 to 71, M_{age} = 59.21 years) were made, for those individuals with and without ASD.
Results: In the NT group, older adults showed consistently poorer social cognition performance on than younger adults. No such age effect was seen in the ASD adults; although more impaired than NT controls in general, young and old adults in the ASD group did not differ significantly from one another in terms of their performance on the social cognition tasks.
Conclusions: This study represents an exploratory and preliminary step to fill the huge gap in the ASD literature concerning ageing. Results may suggest a protective effect on age-related decline in social cognition in ASD. Limitations, alternative explanations, and implications for future research will be discussed.

56 **124.056** State-Level Variation in Vocational Rehabilitation Services and Outcomes for Transition-Age Youth with Autism

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Background:
Vocational Rehabilitation (VR) services might benefit many of the 50,000 youth with autism who turn 18 every year – only half of whom will hold a job for pay at any point between high school and their early 20s – most at part-time hours with low wages. The federal VR program provides grants to states to help individuals with disabilities find, maintain, or regain employment. Transition-age youth (TAY) with autism use VR services more than other age groups do, but they also have the worst employment outcomes.Â Individual-level factors are known to influence employment outcomes. Yet, we know less about the role of where you live in the U.S.
Objectives: Â To characterize variation in individual-level VR services and employment outcomes across states.
Methods: Â We analyzed VR service utilization and employment outcomes for 9,797 TAY with autism (ages 14-24) in the federal Rehabilitation Services Administration (RSA) database who received VR services and had a case that closed in FFY2014. Characteristics of these youth and their VR services use and outcomes were examined using bivariate analyses by state.
Results:
TAY with autism who used VR services were primarily male (84%), white (85%), and non-Hispanic (93%) with a mean age of 19 years at the time of VR entry. Approximately 55% were students when their VR case opened. Approximately one-third (29%) were receiving SSI benefits at VR application, and 68% were considered by VR to have a “most significant” disability. Over half (54%) received four or more VR services.
VR service use and related outcomes varied significantly by state. The percentage of TAY with autism who received VR services during secondary school varied by 70 percentage points across states (mean=68%, range 39-87%). TAY with autism who received VR services and exited with employment varied by 52 points across states (mean=58%, range 29-81%). The median hourly wage of those who exited with employment was $8 but ranged from $7.40 to $10/hour across states. The percentage of TAY with autism who received supported employment (SE) services varied by state. Nine states reported no SE services, while three reported rates of 100% (mean=23%). The amount of money states spent on services for VR service users with autism under age 25 averaged $6100 (range $1470-$9668).
Conclusions: Â Nearly every state has some type of policy, legislation, or activities focused on improving employment opportunities for persons with disabilities. Although individual-level factors contribute to a diverse profile of employment outcomes for TAY with autism, VR service utilization and employment outcomes also vary widely according to the state of residence. Future research should examine the influence of state-level factors on individual outcomes using multilevel modeling methods with a focus on modifiable state-level factors. This study provided contextual baseline data about TAY with autism ahead of the implementation of new federally mandated pre-employment transition services for students– the design of which will also vary by state.

57 **124.057** The Influence of Depression on Adaptive Behaviors and Quality of Life in ASD Compared to Typically Developing Adults

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Background:
Co-occurring depression is prevalent among adults with ASD and is suggested to exacerbate deficits in adaptive behavior and quality of life (QoL) within this population. However, research is required to elucidate the individual and combined contributions of depression and ASD to domains of adaptive behavior and QoL.
Objectives:
1) To replicate findings indicating the association of comorbid depression with poorer adaptive behavior and QoL in adults with ASD.
2) To shed light on the unique influences of depression and ASD on adult outcomes by comparing adaptive behavior and QoL among typically developing adults with depression (TD-dep), adults with ASD with no current depression concerns (ASD-nd), and adults with ASD who score above clinical cut-off on a gold-standard survey of depression symptoms (ASD-dep).
Methods:
Participants included adults aged 18-34 with ASD (n=22) and TD adults with current depression (n=19). Diagnoses were confirmed with the ADOS-2 and the Structured Clinical Interview for DSM Disorders (SCID-5). All participants completed the SRS-2 for a dimensional measure of autism symptomology; the Adaptive Behavior Assessment System (ABAS-3) to assess adaptive behavior in Conceptual, Social, and Practical domains; the World Health Organization Quality of Life scale (WHOQOL-BREF); and the Beck Depression Inventory (BDI-II). Participants with ASD were divided into depression concern (n=10) and no-concern (n=12) groups based on the BDI-II clinical cut-off of 2. Groups were compared on variables of interest using ANOVA with Tukey's post-hoc tests. The effects of depression were assessed dimensionally within ASD using linear regression analyses.
Results:
The ASD-nd subsample was significantly younger than the ASD-dep group. SRS-2 total scores were significantly higher in the ASD-dep group, however TD-dep scores did not differ from ASD-nd. VIQ was not significantly different among the three groups (see Table 1 for all statistics). Adaptive behavior Composite scores were significantly lower for the ASD-dep group (indicating weaker skills) than the TD-dep group. As a group, ASD-nd tended to have poorer adaptive skills than TD-dep but stronger skills than ASD-dep, however no significant differences were found. This trend was preserved across Conceptual, Practical, and Social domains of adaptive behavior. Overall QoL was significantly higher in ASD-nd participants than both other groups, with no difference in QoL between TD-dep and ASD-dep. This trend persisted for all WHOQOL-BREF domains except Social Relationships, in which ASD-dep scores indicated the poorest QoL of all groups, and ASD-nd and TD-dep did not differ significantly. In dimensional analyses within ASD only, higher BDI-II scores predicted lower adaptive behavior Composites, even controlling for VIQ (B=-.398, p=.038), and lower QoL even controlling for autism symptomology (SRS-2) (B=-.764, p=.001).
Conclusions:
Results support findings that comorbid depression further compromises impairments in adaptive behavior and QoL for adults with ASD. Additionally, depression in TD adults appears to be associated with poorer adaptive behavior and QoL similar to those impairments in non-depressed adults with ASD. These data also suggest that depression may have a greater singular impact on QoL than does ASD, although co-occurring depression and ASD still account for the lowest QoL ratings.

58 **124.058** The Map Task: A New Assessment of Functional Capacity in Autism

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Background: There is a need for meaningful predictors of adult functioning for individuals with autism spectrum disorder (ASD). In schizophrenia research, "functional capacity" measures have been developed to assess the underlying ability to carry-out real world functions. We use a new functional capacity measure—the Map Task—that has been validated in a large, cohort of individuals aged 12 to 35 with typical development (TD) or clinical risk for psychosis (McLaughlin et al., 2016). We implemented the task in a group of individuals with ASD aged 12-22.
Objectives: To investigate: (1) how ASD perform on the Map Task relative to TD, (2) whether this measure is related to cognitive functioning or age, and (3) if Map Task performance is associated with adaptive functioning.
Methods: Participants included 23 with ASD (Mean age=15.96), and 28 with TD (Mean age=15.75), matched on perceptual reasoning index (PRI; Wechler 2011). In the Map Task, participants were given a map of a fictional town and were instructed to complete errands quickly by drawing their route on the map. The instructions contained the order for errand completion and an errand list in the incorrect order. Independent variables included: number of errands completed, completion time, and frequency of 4 types of errors -- visiting extra stores, not entering/exiting stores correctly, going the wrong way on a one-way street, and errand order errors (e.g. completing tasks in an illogical order like mailing a card before purchasing the card). We assessed participant cognitive functioning with the NIH Toolbox – Cognition Battery and adaptive functioning with parent reports on the Adaptive Behavior Assessment System (ABAS-3; Harrison & Oakland, 2015). ANCOVAs (with verbal IQ as a covariate) were used to test mean differences on Map Task variables. Pearson correlations between error frequency, child cognition variables, age, and adaptive functioning scores were performed using SPSS 23.
Results: Total errands completed and completion time did not differ between groups. ASD made significantly more errand order errors ($F(1,48)=4.37$, $p=.04$). TD made more errors involving visiting extra stores ($F(1, 48)=4.00$, $p=.05$). The NIH Toolbox cognitive composite score was significantly correlated with errand order errors in both ASD ($r(21)=-.46$, $p<.05$) and TD ($r(26)=-.66$, $p<.001$). Age was negatively correlated with errand order errors in TD ($r(26)=-.60$, $p<.01$), but not in ASD. Finally, PRI was negatively correlated with errand order errors in both ASD ($r(22)=-.45$, $p<.05$) and TD ($r(26)=-.52$, $p<.01$). There were no associations between Maps Task variables and parent reports of adaptive functioning.
Conclusions: Findings indicated that individuals with ASD performed similarly to TD on the Map Task, although ASD made more errand order errors, while TYP visited extra stores. This suggests that ASD follow rules on a small scale (the order the of the list) rather than a large scale (completing all errands in the suggested order). Somewhat surprisingly, we did not observe differences in adaptive functioning in relation to performance on the Map Task. Data collection is ongoing—we will continue to investigate how inattention and cognitive inflexibility are associated with performance on this task.

59 **124.059** Theory of Mind, Early Social Experiences and the Judgment of Harmfulness and Wrongfulness

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Background:
Despite sensational portrayals of persons with ASD committing hideous crimes (e.g., Adam Lanza in the Sandy Hook massacre; Lysiak, Slattery, & Schapiro, 2012), there is no evidence to suggest that persons with ASD are more likely to engage in criminal behaviour (Freckelton, 2013).
Objectives:
The present study sought to identify if some persons with ASD may be vulnerable to involvement in criminal behaviour, not because they are bad people, but because they do not understand the wrongfulness of the situation or the wrongfulness of their actions due to features associated with the disorder, specifically limited early social experiences and poor Theory of Mind (ToM). It was hypothesised that individuals with ASD would have more difficulties making in the moment judgments of wrongfulness than typically developing (TD) individuals, and would base wrongfulness judgments on the actual harmfulness of consequences to a greater degree than TD individuals. Theory of mind (ToM) deficits and limited early social experiences in ASD participants were hypothesised to contribute to these difficulties.
Methods:
Thirty-three individuals with ASD and twenty-seven TD individuals completed an online questionnaire, rating wrongfulness of behaviour in a number of scenarios, both before and after the consequences of the behaviour were revealed; harmfulness was also rated.
Results:
Wrongfulness and harmfulness judgments did not differ significantly between ASD and TD participants, although a dichotomous view of wrongfulness was more prevalent among ASD than TD participants. Harmfulness and wrongfulness ratings were positively correlated for both groups. Both groups tended to change their judgment of wrongfulness if behaviour did not ultimately result in harm, however maintained wrongfulness judgments when harmful consequences occurred. For the ASD group, excluding individuals who viewed wrongfulness
dichotomously, more severe ToM deficits were associated with less differentiation of the severity of harmfulness. However, a relationship between ToM deficits and impaired wrongfulness judgment was not demonstrated nor any link found between judgments of wrongfulness and early social experiences.
Conclusions:
It appears that persons with ASD do not differ from their peers with regard to perceptions of wrongfulness. These findings have relevance in the legal system, particularly in the assessment of competence to commit a crime, when demonstrating the understanding of the wrongfulness of behaviour is a central criterion.

60 **124.060** Transition and Adulthood ASD Survey in Argentina

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Background: Â In 2014, parent and professional organizations in Argentina created RedEA (Red Espectro Autista – Autism Spectrum Network) in order to increase ASD awareness and influence public policy related to ASD. The first project undertaken by RedEA was an ASD early detection awareness campaign called Mirame (Look at Me). In 2016, RedEA developed the Transition and Adulthood ASD Survey to assess the current situation of adolescents and adults with ASD in relation to diagnosis, level of functioning, services, education, employment, housing, money management, leisure and free time activities, social life, health checks, support networks and quality of life. The survey is intended for parents or primary caregivers of individuals with ASD over 13 years old and for individuals with ASD older than 18. After pilot testing of the survey, RedEA members reached a final version by consensus.
Objectives: Â To provide a comprehensive picture of needs, challenges and current situation of adolescents and adults with ASD in Argentina and other Latin American countries with the purpose of successfully enhancing awareness, improving services and developing long-term policy solutions related to ASD in the region.
Methods: The Transition and Adulthood ASD Survey will be broadly disseminated via social networks of RedEA organizations in Argentina during a period of 5 months (November 2016-March 2017) so that caregivers of individuals over 13 and/or adults with ASD older than 18 can complete it online. The survey solicits information about family demographics, individual characteristics, diagnosis, level of functioning, services, education, employment, housing, money management, leisure and free time activities, social life, health checks, support networks and quality of life. It is estimated that more than 400 surveys will be completed in total. After the collection of completed surveys, RedEA researchers will proceed to data cleaning and data analysis, and will draft a report.
Results: A summary of the results from the Transition and Adulthood ASD Survey will be presented, and regional similarities and differences will be analyzed.
Conclusions: The assessment of the current situation of adolescents and adults affected by ASD in Argentina and other Latin American countries is essential for the identification of knowledge gaps, service needs, inclusive education and employment, and quality of life of these individuals and their families. It is also important in the development of culturally relevant strategies for raising awareness about adulthood and ASD, promoting inclusive education, employment and housing, guiding the implementation of successful and improved ASD services and setting priorities for long term national and regional public policy solutions in this age group.

61 **124.061** Using Improv to Facilitate Social Inferencing Skills in Adults with Autism

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Background:
Adults with autism in university and workplace settings continue to face many communication challenges, despite being relative successful in their academic and vocational abilities. Specifically, adults with autism have shown to demonstrate strengths in the structural and content aspects of language, but struggle to use language within the realm of social communication (Murza et al., 2014). A critical challenge in social communication for adults with autism is the inability to accurately read and integrate verbal and nonverbal cues of communication partners to make accurate inferences about feelings, intent, or general behaviors. Learning to make accurate social inferences is critical for adults with autism to integrate and succeed in higher education and develop the skills necessary for success in the 21st century workplace. However, there is a paucity of evidence-based strategies to address social inferencing skills in adults with autism.
Objectives:
The purpose of this research is to evaluate the effectiveness of a 10-week IMPROV based intervention protocol targeted towards improving the social inferencing skills of adults with autism.
Methods:
10 college age students with autism participated in a college based social skills group facilitated by the authors. The social skills group also included 5 typical peers (also college students) who participated in the intervention. Intervention targeted a set of 5 social inferencing rules and strategies identified collaboratively with the participants and adapted from various curricula, including Social Thinking (Crooke, Olswang, Winner, 2016), UCLA PEERS (Laugeson et al., 2015). Weekly sessions were focused on practice of these social inferencing rules/strategies. Each session was organized as follows: a)Warm up/Icebreaker activity, b) Focused Practice of target social inferencing rule/strategy using IMPROV activities (for e.g., utilizing the "Yes And.. IMPROV based strategy to facilitate students' ability to engage in small talk in social settings) which was video-taped, c) Video modeling where participants worked in small groups to create short skits around specific social situations related to the theme of the week (e.g., "you are at the movies and the people in front of you are laughing too loud"), d) Group reflection focused on reviewing the videos to discuss appropriateness and relevance of participant responses in the video. Further participants discussed the relationship of the day's activity to novel social situations.
Results:
Pre-post intervention measures of change in social cognition/inferencing as documented on the TASIT (The Awareness of Social Inference Test, McDonald et al., 2010) revealed variable results probably due to the variability in participant skills prior to intervention. Social validation data gathered from participants indicate that they found this approach to be engaging and useful in increasing awareness of appropriate social communication strategies. Video-coding and analysis of group reflections utilizing thematic analysis will be shared- offering important stakeholder perspectives on the utility of IMPROV based interventions for adults with autism.
Conclusions:
Young adults with autism present with unique skills and challenges. IMPROV based interventions may offer a unique opportunity to help adults with autism explore and practice use of appropriate social cues and strategies.

62 **124.062** What Is Important for Quality of Life in Adolescents and Adults with ASD? Results from a Nation-Wide Danish Follow-up Study.

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Background: Â It is becoming increasingly common to measure Quality of life (QoL) among people with autism spectrum disorders (ASD). Most often, this is undertaken by using proxy reporting but letting people with ASD self-report on their QoL is possible and in some researchers' opinion the most correct method to apply. Furthermore, it is important to explore the factors of importance for having a higher level of QoL. However, usually only a few factors are included within a study, which makes it difficult to conduct a profound analysis of, what is important for QoL. Additionally, the ASD populations studied are often characterized by few females within each sample and a large age-span, including diversity in age at diagnosis.Â
Objectives: To investigate a range of diverse factors characterized as primarily within-person or between-person factors and their possible associations to different levels of QoL in a large population of adolescents and adults with ASD between 16 and 26 years.
Methods: Â In this nation-wide, follow-up study, 5642 adolescents and adults born in the period 1990-1999 and diagnosed with ASD before turning 14 years were invited to participate in an online survey together with their parents. The adolescents and adults with ASD were identified in the Danish Psychiatric Central Registry. Besides obtaining information about QoL, this survey includes scales and questions composing variables that can be characterized as primarily within-person factors; adaptive functioning, autistic symptomatology, psychiatric comorbidity and maladaptive functioning, and variables that can be characterized as primarily between-person factors; parent empowerment, type(s) of daytime occupation, and received support and intervention. QoL was measured applying three different scales to the ASD study population: The INICO-FEAPS Scale, Personal Wellbeing Index and a single-item visual analogue scale. Using regression models, the data analysis will examine these factors' contribution to different self-reported QoL levels in the study population. Furthermore, possible pathways between the factors will be explored.
Results: A total of 1731 parents corresponding to a response rate of 30,7% and 931 adolescents and adults with ASD corresponding to a response rate of 16,5% returned the questionnaire in the survey. This study is based on a subsample of the total sample (N=702). Mean age for the ASD population is 20,6 years (SD=2,77) with a male:female ratio of 1:0.25. The following ICD-10 diagnoses are represented (percentage of total sample): Infantile autism (28%), atypical autism (11%), Asperger's syndrome (43%) and pervasive developmental disorder, not otherwise specified (13%). For 5% of the sample it was not possible to classify the ASD diagnosis according to ICD-10. In the further analyses, factors contributing to different levels of QoL will be highlighted.Â
Conclusions: This nation-wide study which is among the largest performed to date will provide knowledge about factors associated with self-reported QoL among adolescents and adults with ASD including both within-person and between-person factors in the analysis to broaden the comprehension of how to understand and improve QoL in this population.

63 **124.063** What Skills Should Adaptive Functioning Interventions for Intellectually Able, Transition-Aged Youth Target? an Examination of Caregiver Responses on the Vineland-II

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Background: Research indicates the need for effective adaptive functioning (AF) interventions for intellectually able adolescents and adults with autism spectrum disorder (ASD). Specifically, adult outcomes are suboptimal (Eaves & Ho, 2008; Gary et al., 2014), and development of AF skills in intellectually able individuals appears to stagnate relative to cognitive development (Kanne et al., 2011). In order to develop effective interventions, targets must first be identified.
Objectives:
(1) To examine profiles of intellectual and adaptive functioning in intellectually able adolescents and adults and with ASD.
(2) To identify daily living skills (DLS) that the majority of intellectually able individuals and adults are unable to complete independently.
Methods: Participants were 29 adolescents (*M* age = 15.20, *SD* = 1.10), 37 young adults (*M* age = 21.22, *SD*= 2.95), and one caregiver of each participant. Participants had a DSM-IV or DSM-5 ASD diagnosis, met criteria for autism or autism spectrum on the ADOS or ADOS-2 administered by a research reliable rater, and had a composite IQ of 70 or above on the KBIT-2 (Kauffman & Kauffman, 2004). Each caregiver was administered the Vineland Adaptive Behavior Scales Survey Interview, Second Edition (Sparrow et al., 2005).
Results:
A 2 (age group) x 4 (IQ, Communication, DLS, Socialization) ANOVA was used to examine profiles of intellectual and adaptive functioning. The adolescent group had significantly higher scores than the adult group on all assessments ($F(1, 64) = 22.40$, $p < .001$; pairwise ps < .01). Across groups, intellectual functioning was significantly higher than all AF domains ($F(3, 192) = 140.01$, $p < .001$; pairwise ps < .001). The group by assessment interaction was not significant. Because the adolescent group had significantly higher IQs than the adult group, a 2 (age group) x 3 (AF domains) ANCOVA controlling for IQ was conducted. The adolescent group had higher (ps < .02) or marginally higher (socialization: $p = .09$) scores in all three domains ($F(1, 63) = 6.79$, $p = .01$). The main effect of AF domain and the interaction were not significant. Across groups, socialization scores were significantly lower than communication and DLS scores (pairwise ps < .001). DLS items were examined separately using percentages. DLS items were selected for analyses given their relevance to independent living and employment. Items for which more than one third of the sample were not functioning independently were identified as potential intervention targets (Table 1).
Conclusions: Findings replicate previous reports of a gap between intellectual and adaptive functioning in intellectually able individuals. Additionally, response percentages identified a number of skills that the majority of adolescents and adults in the current sample do not complete independently. These skills should be considered in the development of AF interventions for transition-aged youth. Reinforcing the need for this type of intervention, very few adult participants had held a part-time ($n = 7$) or full-time ($n = 1$) job for at least one year.

64 **124.064** Young Adults on the Autism Spectrum: College Experiences and Outcomes

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Background: There is limited information on outcomes for young adults with autism spectrum disorder (ASD) in many areas, including postsecondary education.
Objectives: To explore experiences of young adults with ASD and their families related to postsecondary education with an emphasis on common challenges and success factors.
Methods: Qualitative interviews addressing post high school experiences were conducted with 35 parents and 14 young adults with ASD. Interviews were transcribed; material relating to experiences at community or 4-year colleges was segregated, then coded using a grounded theory approach.
Results: Nineteen young adults, ages 19-31, reported a degree-seeking college experience. Several themes surrounding success or failure at college emerged. ***Student Preparedness:*** Most students with ASD were well prepared academically, but faced obstacles as a result of core social deficits, executive functioning challenges, rigidity, and mental health issues (e.g. anxiety). Academic achievement fed into what one mother called "a whole collective fantasy" that academics trumped all else on the part of high school, parents, and youth. As a result, deficits in navigating the social world, organization, self-advocacy, and daily living skills were minimally addressed. These deficits became glaring at college, sometimes resulting in catastrophic failure. A father of his son: "*He lasted 72 days… He never went to the dining hall once. He could not handle the dining hall, he could not handle the noise, he could not handle the whole thing.*" ***Student/College Fit:*** When student challenges were taken into account, success was more likely. Students who stayed closer to home and chose a smaller college with a culture accepting of difference did better. The ability to ease in by taking a reduced load was important, but not always accommodated by policies requiring full time attendance for financial aid or on-campus housing. A mother of her daughter: "*She fairly quickly found this kind of funky eccentric group and they hung out a lot together and she was the happiest I've ever seen her in her life.*" ***Student Challenges, Campus Supports, and Family Support:*** College students with ASD often struggled socially, sometimes becoming isolated or alienating peers. Issues with organization and planning could lead to falling behind and panic; a tendency not to tell anyone when they were in trouble made things worse. Academic accommodations typically offered were not designed to address social and executive functioning issues. Families often stepped in to bridge this gap, trying to monitor student performance, provide emotional support, and advocate when the student could not. Some paid for peer mentors, tutors, or formal student support programs. A mother of her son: "*They said they can give you a tutor… The problem is that he has to initiate this, he has to walk to the disability department to talk to them, but he didn't…*"
Conclusions: Many students with ASD face significant challenges at college. A better understanding of how both organizational practices and ASD-associated difficulties interfere with success may help high schools, parents, and colleges more effectively support youth with ASD as they plan for or attend institutions of postsecondary education.

65 **124.065** Self-Advocacy and Emerging Adults on the Autism Spectrum

V. Paradiz*, Valerie Paradiz LLC, Boulder, CO*

Background:
As young adults with autism leave the shelter of educational entitlements and the family home and transition into higher education and employment, self-advocacy is indispensable. Self-advocacy and transition planning programs are available for the general disability population, and there is a small body of literature regarding their effectiveness in positively impacting measures of self-determination, improved self-advocacy, and decision-making. However, a vital need for self-advocacy curricula remains, specifically for young people with autism in transition to adulthood. In addition, studies of such curricula to measure outcomes and to establish standards of practice in instruction are virtually non-existent. Illustrations from the panel participant's experience as a person with autism and as a parent of a young adult with autism will be shared.
Objectives:
For individuals with autism especially, learning skills to increase awareness of environmental triggers, cues, and situations that require self-advocacy decisions are essential. For example, an individual can work to understand how his or her own physiology and sensory experience interface with a given environment and then develop a strategy to improve his or her participation in that setting. Social awareness is another core component of self-advocacy development. For many individuals on the autism spectrum, addressing social challenges and differences, such as interpreting non-verbal cues, managing anxiety, and navigating workplace or college campus interactions, will be a high-frequency need that requires self-advocacy strategies. Supports and instruction aimed at improving ability should address self-regulation plans and strategies. Such plans should be developed out of the interplay between a person's self-awareness and social-environmental understanding.
Methods:
Strong self-advocacy programs for individuals with disabilities are built on several key components. An individual's development of self-determination is paramount, with an emphasis on communicating, acting, and decision-making. Illustrative examples from evidence-based, self-advocacy curricula and programs—specifically the Integrated Self Advocacy ISA programs—will be provided. Case studies will illustrate methods of increasing self-advocacy competencies for young adults in the workplace and in higher education settings.
Results:
Case data on the ISA Sensory and Social Scans put into practice in autism transition classrooms will be provided, with further summary discussion of the state of very limited research in self-advocacy measures, outcomes and effective programming. Additionally, ISA instruments for assessing self-advocacy competencies and measuring individualized progress on self-advocacy goals will be introduced.
Conclusions:
500,000 students with autism are expected to exit high school into young adult life in the next decade. Ensuring that young adults with autism not only understand their differences, but also have the liberty and power to act on their needs and rights both at work and in higher education settings, is one of the most essential lessons we can impart to them as they transition to adulthood. Greater efforts are needed in funding, establishing and researching self-advocacy curricula and programs in order to move the needle on real-world outcomes for young adults with autism who currently face unspeakably high rates of disengagement from employment and higher education in the years immediately following high school.

66 **124.066** Family Sex Communication for Young Adults with Autism Spectrum Disorder

T. Kozikowski[1] *and C. Warren*[2]*, (1)Eastern Virginia Medical School, Norfolk, VA, (2)Organizational Sciences and Communication, The George Washington University, Washington, DC*

Background: Previous research has suggested that many of the problems surrounding ASD and sexuality may be helped through family communication and education that are geared toward individuals with ASD. There has not been substantive research, however, as to what specific aspects of family communication about sexuality may need to be emphasized or altered for this population. Dr. Clay Warren developed the FSCQ along with Dr. Michael Neer in 1986. This measure evaluates child and parent communication about sexuality on three dimensions: comfort, information, and value. The current study represents the first time this measure was used to evaluate communication about sexuality between young adults with ASD and their parents.
Objectives: The purpose of this presentation is to address the first data on family communication about sex from young adults with autism spectrum disorder (ASD) and their parents collected via the Family Sex Communication Questionnaire (FSCQ). It will offer insights about family sex communication research collected over the thirty years since the development of the FSCQ from its author, Dr. Clay Warren. The presentation's primary focal points will be the differentiation of two regularly confused terms - sex education and sex communication - and the need for ASD young adults to have better sex communication with family members (with particular emphasis on the comfort dimension of the FSCQ).
Methods: 118 young adults with ASD (ages 18-30; 44% female) and their parents completed the FSCQ via an anonymous on-line survey. Young adults and parents from the same family were grouped together through a unique four digit code to ensure that data could be properly analyzed through paired samples t-tests.
Results: Â Paired samples t-tests were used to evaluate differences between parent and young adult reports on the FSCQ overall and its sub-scales. Results showed that young adults reported significantly lower comfort (t [115] = 13.56, $p < 0.001$), information (t [116] = 3.54, $p < 0.001$), and overall (t [117] = 6.28, $p < 0.001$) scores when compared to their parents. However, the two groups did not differ on the value sub-scale (t [116] = -0.17, $p = 0.87$). See Table 1 for the summarized descriptive statistics.
Conclusions: Â Young adults with ASD have lower levels of comfort and information but similar levels of value placed on family communication about sex when compared to the outcomes of their parents. Moreover, both parents and young adults reported lower than strong overall FSCQ scores (≤ 72). These results indicate that although parents and young adults are reporting different levels of comfort and information gained from communicating about sex, they both value communication about sex in general on the same level. In addition, the overall FSCQ scores of young adults are significantly lower than those of the parent group. Therefore, this study's outcome suggests it may be important to focus on aligning comfort and information facets, as well as boosting overall FSCQ levels (particularly those of young adults with ASD), in order to increase the overall effectiveness of family communication patterns about sex for this target group.

67 **124.067** Sexuality and the Autism Spectrum: Implications for Individuals with the Broad Autism Phenotype

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Background: Differences in sexual behaviors exist between individuals with Autism Spectrum Disorder (ASD) and Typical Development (TD), with ASD individuals having fewer relationships and sexual experiences than their TD counterparts. Studies have also found differences in sexual orientation between people with ASD and TD, with women with ASD endorsing more lesbian or bisexual sexual identity and people of both genders with ASD endorsing a more asexual identity. Some people with TD have characteristics of autism but not the full disorder (Broad Autism Phenotype; BAP) and may have similar difficulties to people with autism. One area of difficulty may be expressing their sexuality, especially if they experience same-sex attraction. If the BAP is seen as being a part of the overall autism spectrum, then it is possible that any of the causes of increased incidence of non-heterosexuality and difficulty participating in sexual behavior in those with ASD could also affect those with the BAP.
Objectives: The purpose of this study is to measure the characteristics of the BAP, sexual experiences, and sexual orientation in a TD population to see if those who have more characteristics of the BAP show similar patterns of sexual behavior and sexual orientation to those of people with ASD, as reported in the literature.
Methods: Participants with typical development were recruited from a large mid-Atlantic University and from various online survey and social media sites. They were asked to complete a set of questionnaires that included the Autism Spectrum Quotient (AQ) and Broad Autism Phenotype Questionnaire (BAPQ) to measure traits of the BAP, the Klein Sexual Orientation Grid (KSOG) to measure sexual orientation, and a modified Brief Index of Sexual Functioning (BISF). The survey was completed anonymously online and student participants were compensated with course credit.
Results: Two sets of linear hierarchical multiple regressions will be calculated with the AQ and BAPQ serving as the predictor variables and sexual orientation and partnered sexual behaviors serving as the criterion variables. The same demographic predictors will be used for each regression equation. For Hypothesis 1, partnered sexual behavior as measured by the BISF will be predicted from the demographic variables entered at Step 1 and the AQ entered at Step 2. A similar analysis will then be run using the BAPQ instead of the AQ as the predictor in Step 2. For Hypothesis 2, sexual orientation as measured by the KSOG will be predicted from the demographic variables entered at Step 1 and the AQ entered at Step 2. A similar analysis will then be run predicting sexual orientation using the BAPQ instead of the AQ in Step 2.
Conclusions: Two hundred and fifty responses have been collected for this study and data analysis is underway. We hypothesize to find the following: BAP traits will negatively predict partnered sexual behaviors and positively predict greater homosexual sexuality, above and beyond the demographic variables.

68 **124.068** Autism, Sexuality, and the Law: A Case Study

***S. Carr**, Rehabilitation Research and Training Center, Virginia Commonwealth University, Richmond, VA*

Background: Most individuals with an autism diagnosis experience puberty and sexual development at the same rate as their peers (Lawson 2005; Murphy and Elias 2006). They however do not follow typical stages of development in social communication and social interaction (Atwood, 2014). These deficits become increasingly apparent in adolescence and young adulthood, when individuals are expected develop close friendships and romantic and relationships (Seltzer et al. 2003). The imbalance of development between physical and sexual and social- emotional coupled with deficits in Theory of Mind can lead to atypical interactions with peers leading to misunderstandings, inappropriate sexual activity, and potential legal consequences.
Objectives: To identify the social, emotional and communicative deficits that lead to incarceration of a young adult with autism.
Methods: This single-subject case study followed a young man with autism from arrest through trials and incarceration for sexual abuse spanning 5 years. In depth record review and analysis of psychological reports and assessments, court proceedings and evidence along with observation, interviews, and assessment were utilized to identify how a complex set of circumstances related to the core deficits of autism resulted in criminal charges.
Results: Results of this 5-year case-study resulted in identification of three specific deficits in psychosexual understanding including: lack of understanding of non-verbal cues (body language), misinterpretation of tone of voice, and lack of perspective taking.
Conclusions: The results from this longitudinal case study indicate the need for future research and interventions to address the intimate/social/sexual relationships and behaviors of individuals with autism. These interventions should target sexual education, social development, and sexual guidelines and consequences for aberrant sexual behavior.

69 **124.069** Problem Solving in Sexuality Education

***R. L. Loftin**[1], A. Burns[2] and E. T. Crehan[1], (1)AARTS Center, Rush University Medical Center, Chicago, IL, (2)AARTS Center, Rush University Medical Centre, Chicago, IL*

Background:
There is an urgent need to teach people with ASD about the social aspects, not simply the basic facts, of sexuality. Most people with ASD desire an intimate relationship (Healy et al, 2009; Koegel et al, 2014), but relatively few are able to form the partnership they desire (Hancock, Pecora, Mesibov, & Stokes, 2017). It appears that the social difficulties inherent in ASD are directly related to social isolation and loneliness (White & Roberson-Nay, 2009) experienced when relationships fail. An intervention was developed to address both sexuality education and social problem solving – the application of knowledge in real-world social situations,. The proposed presentation assessed use of a manual for sexuality education that was developed by ASD specialists and a consultant from Planned Parenthood and coupled sexuality education with social problem solving instruction.
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Objectives:
This presentation will outline the outcomes from a pilot investigation of sexuality education with social problem solving.
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Methods:
Ten young men with ASD (confirmed with ADOS2 administration and expert clinician diagnosis) completed a 14-week sexuality education course. The intervention was implemented by educators and/or master's level clinicians with training in ASD. The manual was based on a published curriculum (Davies & Dubie, 2012). Planned Parenthood's standards, adapted from the federal standards for sexuality education, were used as a framework for editing of the Davies and Dubie manual. Supplementary lessons were created for additional areas of need that were not fully addressed: legality/illegality of pornography and consent. In each session, instructors led participants through at least one example of problem solving following the standard 5-step model of social problem solving (D'Zurilla & Goldfried, 1971). Examples were tied to each week's content.
All participants participated in pre- and post-testing that included measures of social validity, knowledge questionnaires and vignettes of situations to assess social problem solving. Feedback from participants, course leaders and parents was collected to assess acceptability of the intervention.

Results:
Participants demonstrated knowledge acquisition in most areas; learning in some discrete topics was mixed. Surprisingly, knowledge of HIV went down, while knowledge of anatomy, male sexual function, and social-sexual boundaries increased. In response to the social problem solving vignettes, improvements in identifying the problem and offering realistic alternatives to solve the problem of were apparent in eight of ten participants, while two participants demonstrated no change. Acceptability among attendees was good, and feasibility of the intervention was high.

Conclusions:
There is a need for comprehensive sexuality instruction for people with ASD. Instruction in social problem solving is an important component to promote healthy outcomes and prevent problem behaviors. It appears that including a social problem-solving component in the regular instruction may improve problem solving, at least in testing situations. Additional study is needed to confirm that problem solving carries over to the natural setting. Given what we understand about autism, generalization deficits, and social problem solving challenges, however, it is likely that social problem solving instruction specific to sexual topics will be a valuable component of sexuality education curricula for this population.

Poster Session
125 - Brain Function (fMRI, fcMRI, MRS, EEG, ERP, MEG) I
5:30 PM - 7:00 PM - Golden Gate Ballroom

70 **125.070** A Functional MRI Meta-Analysis of Reward and Social Motivation Studies of ASD

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Background: Â The Social Motivation Hypothesis posits that individuals with autism spectrum disorder (ASD) show diminished social motivation and responsiveness to social rewards (Chevallier et al., 2012). Two types of motivation typically distinguished are the "liking" of the reward that occurs during its consumption, and the preceding "wanting" of the reward (Berridge, Robinson, & Aldridge, 2009). Per the Social Motivation Hypothesis, people with ASD may 'like' and thus 'want' social interactions less, leading to fewer social learning opportunities and diminished social skills. Functional MRI studies can distinguish between 'wanting' and 'liking' a reward since the two processes are somewhat distinct in timing and neurobiological circuitry. However, it has been difficult to draw strong conclusions as the few studies on this topic have had limited sample sizes. For this reason, a meta-analysis synthesizing the current data may provide needed clarity.
Objectives: Â To use fMRI-specific meta-analytic techniques to 1) obtain information about the direction and magnitude of differences in reward processing in individuals with ASD relative to typically developing controls (TDCs), and 2) identify potential moderators of observed differences.
Methods: Â We systematically reviewed the fMRI literature on individuals with ASD and identified nine papers meeting inclusion criteria for meta-analysis. We leveraged novel fMRI meta-analytic methodology (Effect Size Signed Differential Mapping; Radua et al, 2012) to account for effect magnitude, effect direction, sample size, and covariates (age and IQ), since study samples showed a large range in mean ages (12-37 years) and IQs (103-127).
Results: Â Activation differences were observed in the ventral striatum and other regions (hypoactivation in the left nucleus accumbens (-6,6,-6), posterior cingulate gyrus (4,-6,30), right caudate nucleus (10,6,20), and right frontal pole (28,64,12), and hyperactivation in the hippocampus (26,-14,-34); all p's<.001) during 'wanting' of monetary but not social reward in individuals with ASD relative to TDCs, and no significant differences in 'liking' of reward. When we statistically controlled for the age of each sample in exploratory meta-regression, these results were no longer statistically significant, suggesting potentially important age effects in reward processing that have not been adequately accounted for to date. In analyses covarying mean IQ, the left nucleus accumbens and right anterior hippocampus results were preserved and the posterior cingulate gyrus result shifted dorsally (toward anterior cingulate gyrus).
Conclusions: Â These results suggest different processing of non-social reward during the 'wanting' but not the 'liking' phases of reward processing in individuals with ASD. The challenges of providing naturalistic social rewards in the lab, compared to providing actual monetary rewards, may contribute to the observed absence of differences in response to social reward. In addition, the effect for group differences in social reward conditions may be difficult to detect with the sample sizes traditionally used in this field. Exploratory meta-regression results highlight key differences between the ages and IQs of study samples that may explain contradictory results in the literature. Our results suggest that careful examination of current paradigms and systematic investigation of reward processing in ASD at different ages may be necessary to fully understand social motivation in autism.

71 **125.071** A Graph Theoretic Examination of Social Brain Networks at Rest in ASD

D. Moraczewski[1], *D. Levitas*[1] *and E. Redcay*[2], *(1)University of Maryland, College Park, MD, (2)Department of Psychology, University of Maryland, College Park, MD*

Background: Deficits in social interaction and social communication are core features of autism spectrum disorder (ASD). Dominant theories suggest that these deficits may be due to reduced or atypical social motivation (i.e., the motivation to seek out social interaction) and/or social cognition (i.e., inferring and reasoning about the mental states of others). Further, these social motivation and social cognitive systems may be linked such that reduced social motivation may affect social-cognitive development. While studies have demonstrated atypicalities of both social-cognitive and motivational networks in ASD, these typically are not examined together within the same individual. Further, key nodes within each of these networks such as the amygdala (social motivation) and temporo-parietal junction (TPJ) (social-cognition) may contribute to these atypicalities, as they play an integrative role both within and between functional networks.
Objectives:
We use resting state functional connectivity, which is an ideal method to examine baseline functional network organization, to examine within and between network organization with a focus on key nodes within networks associated with social motivation (amygdala) and social cognition (TPJ) using graph theoretic methods.
Methods:
Using the Autism Brain Imaging Database Exchange, we examined network organization in both ASD (N=79) and TD (N=104) groups. After strict motion control (mean frame displacement < 0.1mm), age, and gender matching, our final sample included N=76 individuals (ASD=30;TD=46; age range: 6.47-19.73, all male). Whole-brain networks were constructed from a freely available functional atlas (Yeo 17-networks), bilateral amygdala, and 12 ventral striatum regions for a total of 128 nodes. In order to examine within and between network organization, we assigned two community affiliations of interest. The social motivation community consisted of the amygdala, ventral striatum, and OFC and, since previous work has implicated the default mode network (DMN) in social-cognitive processing, we assigned the social-cognitive community as all DMN regions. All other regions preserved their community affiliation from the functional atlas. We used graph theory to calculate measures of within- and between-community connectivity for each key node (within-community connections and participation coefficient, respectively). Finally, controlling for head motion, we examined these metrics for group, age, and group*age effects.
Results:
For between-network connectivity, we found significant group ($F(1,71)=5.31, p<0.05$) and group*age ($F(1,71)=10.41, p<0.01$) effects in the left TPJ such that this region became less functionally connected with other communities with age in ASD and increased in connectivity in TD. Similar effects were seen in the right TPJ, but only reached trend level significance. No significant between-network effects were seen in the amygdala. For within-network connectivity, no significant effects were seen in either of the key nodes.
Conclusions:
Our results highlight a differential timecourse in the left TPJ's role in connecting the social-cognitive network with other large-scale networks. While we do not see differences within the amygdala, a key node within the social reward network, group difference may manifest earlier in development and/or be exacerbated in the presence of socially salient stimuli. Our results have implications for understanding functional brain development in ASD at the network level.

72 **125.072** A Novel Electrophysiological Marker of Autism Spectrum Disorder Based on Facial Expression Mental Imagery

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Background:
The diagnosis of autism spectrum disorder (ASD) is based on behavioural assessment by multidisciplinary specialized teams. Therefore, it is not free of subjective bias and there is a need for specific 'biological markers' (or 'biomarkers'). Several biological characteristics of the disorder have been recently identified, especially in the field of functional genomics. However, they only cover a small percentage of the cases (between 15 to 20%). Some studies addressed neural coherence deficits to propose EEG-based classifiers. Here, we assessed the possibility of using face processing specific metrics to achieve neurophysiological discriminations.
Objectives:
To create a discriminant classifier between ASD andÂ typically development (TD) individuals capable to automatically identify if a new individual belongs to the ASD or TD group, using electroencephalography (EEG) data of mental imagery of facial expressions.
Methods:
Participants with ASD (n=17) and TD controls (n=17), matched by age and performance intelligence quotient, underwent a mental imagery task of happy vs. sad facial expressions in a virtual avatar while recording EEG from 58 scalp locations. The experimental design consisted of visualizing the avatar performing a dynamic facial expression (happy or sad) and then, after an auditory cue, imagining the avatar performing it again.
EEG data were preprocessed in order to remove bad channels and segments and to correct for artifacts. Thereafter, a group of features from time, frequency and non-linear domains were extracted for each electrode and for 7 frequency bands: theta, alpha, beta, 3 beta sub-bands and low-gama.
We conducted feature selection on the data in order to identify the clusters of electrodes and frequency bands that better discriminate the groups. Then, the best subset was used following a leave-one-out cross-validation approach. Training data were transformed through a Principal Component Analysis and the first four components were used to train the linear support vector machine. The same transformation was applied on the test set and then we measured the classifier accuracy. This analysis was paired with resting-state data in order to assess if results are task-specific or related to the ongoing EEG activity (in a baseline of neutral faces).
Results:
Feature selection showed that the best electrode clusters were located in right Fronto-Temporal, right Centro-Parietal, left Centro-Parietal, and right Parieto-Occipital regions. Best discriminating frequency bands were theta, high-beta and low-gama. Our classifier achieved 88.2% accuracy, 94.1% specificity and 82.4% sensitivity using just 4 principal components. Results with resting-state data (neutral face baseline) presented only 73.5% accuracy, 70.5% specificity and 76.5% sensitivity.
Conclusions:
Our results suggest that is possible to use EEG data from facial imagery to discriminate individuals with ASD and TD. The most discriminating cluster locations are coincident with the face perception network and the high accuracy achieved by the classifier suggests that the impairments of the ASD group in facial expressions processing and their mental imagery represent a robust biological phenotype. Results from resting-state data suggest some differences are present on ongoing activity, even when only a neutral face is present, but the accuracy increases significantly when subjects have to perform explicit imagery.

73 **125.073** A Simultaneous EEG, TMS and Eye-Tracking Study Investigating Mirror Neuron System Activity in Adults with Autism Spectrum Disorder When Inferring Intentions.

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Background: Autism spectrum disorder (ASD) is associated with difficulties inferring the internal states of others such as their intentions, beliefs or mental states. These are known as mentalizing tasks. Neuroimaging studies have found mirror neuron system (MNS) activity during these tasks and it has been hypothesised that MNS dysfunction may underlie mentalizing difficulties associated with ASD. However, MNS activation during mentalizing tasks may be simply due to the use of stimuli depicting biological motion and evidence regarding MNS dysfunction in adults with ASD is limited. This study investigated whether MNS activity was higher when mentalizing than in a control task when the same stimuli were used, and whether MNS functioning was atypical in adults with ASD.
Objectives: We used EEG and single-pulse TMS techniques to identify potential differences in MNS activity in high-functioning adults with ASD when inferring intentions from hand actions.
Methods: Thirteen adults with ASD and thirty control participants (15 low AQ, 15 high AQ) watched videos of actors performing hand actions. Participants were either asked to infer the actors' intentions (mentalizing task) or the success of the action (control task). TMS-induced motor evoked potentials (MEPs) and mu suppression measured by EEG were both used as indices of MNS activity. Eye-tracking data were also collected in order to identify any differences in fixation patterns associated with ASD.
Results: Â The EEG data showed lower levels of mu suppression during the mentalizing task across all groups. TMS-induced MEPs were largest when participants watched actions in which the intentions of the actors were not fulfilled (clumsy/accidental actions) even when participants were not directly asked to infer intentions. No differences in MNS activity associated with ASD were found. Eye-tracking data showed participants with low AQ scores looked at the head of actors more often and for longer during the mentalizing task but adults with high levels of autistic traits both with and without a diagnosis did not.
Conclusions: Â Our eye-tracking data imply that adults with high levels of autistic traits (with and without a diagnosis) do not alter their fixation patterns across mentalizing and non-mentalizing tasks in the same way as adults with low autistic traits. Despite this, no differences in abilities to infer the intentions of others or MNS activity were found associated with ASD. The TMS data suggest the MNS has a role in coding the consistency of a person's actions with their initial intentions, consistent with the predictive coding theory (Kilner, Friston & Frith, 2007). However, the EEG data provide evidence against MNS involvement in mentalizing tasks. Therefore TMS-induced MEPs and mu suppression appear to measure different aspects of MNS activity, consistent with previous studies (e.g. Lepage,Â Saint-Amour &Â Théoret, 2008).
Keywords: Transcranial magnetic stimulation (TMS), electroencephalography (EEG), mentalizing, eye-tracking

74 **125.074** Age-Related Changes in Auditory Event-Related Potentials Differ Between Typically Developing Toddlers and Those with Autism Spectrum Disorder.

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Background: Unusual sensory-related behaviors, particularly in response to sound and touch, are associated with the phenotype of autism spectrum disorder (ASD) and such behaviors are now part of DSM-V criteria. However, little is known about the developmental trajectory of brain responses elicited by sensory stimuli in young children with ASD or how they differ from those in typically developing children.
Objectives: In this study, part of a larger, on-going project to identify autism subphenotypes (The Autism Phenome Project), we sought to identify the relation between chronological age and electrophysiological markers of auditory sensory processing in young typically developing children and those with ASD. Our approach was to examine the electrocortical response amplitude to stimuli of increasing loudness.
Methods: 61-channel event-related potentials (ERPs) were elicited by randomly presented 50, 60, 70, and 80 dB 50-ms complex tones via headphones from 31 typically developing (TD) and 52 children diagnosed with ASD. Diagnostic criteria were based on ADOS, ADI-R, DSM-IV and clinical observation. All children (26 - 63 mos.) had clinically normal hearing. A total of ~1200 stimuli with inter-stimulus intervals of 1-2 s were presented as children passively listened to the stimuli and watched a quiet video of their choice. Gross artifact-free average referenced concatenated epochs from -200 to +600 ms were submitted to Second Order Blind source Identification (SOBI) and signal sources identified as noise (e.g. emg, blinks) were removed. The remaining sources were combined, projected back into electrode space, and averaged by intensity per individual. The global field power (GFP) waveforms were analyzed time-point by time-point separately by intensity using Group (TD vs. ASD) as a between subjects factor and Age as a covariate. Significant time periods of Group by Age interactions were identified using a threshold of at least 15 contiguous time-points with $p<=0.05$. For each individual at each stimulus intensity level, we computed the average GFP across post-stimulus time windows defined by durations of significant interactions. Pearson correlations of these GFP values and age were performed.
Results: Significant Group by Age interaction time windows were found for 50 dB (70-100 ms), 60 dB (70-95 ms), and 70 dB (285-330ms) stimulus intensities. For all three of these conditions we observed significant correlations of increasing GFP amplitude with age for the TD children (50 dB TD $r = 0.49$, $p<.001$; 60 dB TD $r = 0.47$, $p<.001$; 70 dB TD $r = 0.36$, $p=.04$). No significant correlations with age were found in the ASD group.
Conclusions: These data extend the corpus of results demonstrating differences in auditory responses between TD children and those with ASD to investigation of ages 2-5 years—a period of development which includes marked changes in neuroanatomical maturation, cognitive development and typical acquisition of interpersonal skills. The data suggest that there are brain maturational-dependent processes present in TD children that may be delayed or disturbed in ASD. These results are in line with white matter tract differences that have been shown to differ in maturation between TD and ASD children of the same age range.

75 **125.075** Altered Neuromagnetic Evoked Responses and Neural Synchrony Related to Language in Autism Spectrum Disorder

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Background:
Autism Spectrum Disorder (ASD) is characterized by atypical social and language functioning. Atypical electrophysiological signatures of auditory processing in ASD may provide evidence informing cascading impairment of higher-order social and language functioning (Brennan et al., 2016).
Objectives: Relationships between evoked response, synchrony, phonological processing (PP) and social communication were investigated.
Methods:
Eleven ASD (Age: M = 8.8; SD= 0.9) and 10 neurotypical (NT) children (Age: M = 9.4; SD = 1.4) underwent magnetoencephalography (MEG) at rest and during an oddball paradigm, which consisted of presentation of plausible (S1) and implausible syllables (S2). M100, M200, M250, and M300 amplitudes and latencies were quantified for evoked responses (ERP). An amplitude difference score (S1-S2) was calculated to reflect auditory sensitivity to novel language. It was hypothesized that decreased S2 sensitivity (smaller S1-S2 scores) would be associated with better PP and communication. Synchronization was quantified by calculating coherence between cortical sites. Kendall Tau correlations were computed to examine relationships between ERP, coherence, PP, and communication skills.
Results:
There were no group differences in amplitude, latency, sensitivity or PP (p>.05). NT had significantly higher communication skills, per parent report (p<.001). *ERP*: Higher communication skills were associated with longer S1 M300 latencies in ASD (p=.02) and shorter S1 M200 latencies in NT (p=.01). Significant associations between ERPs and PP were found at different latencies. In ASD, longer S2 M250 latencies (p=.02) and higher S1 M250 amps (p=.02) were associated with higher PP. Poorer M300 sensitivity was associated with higher PP (p=.04). In NT, longer S2 M100 latencies were associated with higher PP (p=.01). *Coherence*: In ASD, decreased interhemispheric angular to inferior temporal coherence was associated with larger S1 amplitudes at M250. In NT, higher intra- and interhemispheric cingulo-fronto-temporo-parietal coherence was associated with shorter S1 M200 latencies. Lower intra- and interhemispheric left angular to frontal region coherence was associated with longer S2 M100 latencies.
Conclusions:
There were no significant group differences in PP; however, there were significant group differences in parent reported communication skills. Despite a lack of significant PP group differences, differential electrophysiological profiles emerged. In NT, better PP was associated with longer M100 latencies (a latency associated with exogenous attributes of auditory stimuli) for implausible words and better communication was associated with shorter M200 latencies (latency associated with endogenous attributes of auditory stimuli) in response to plausible words. In ASD, a different profile emerged. *Longer* latencies and higher amplitudes at a latency associated with auditory processing of endogenous information was associated with *better* PP. Better PP was associated with poorer M300 gating, a latency associated with responding to deviant sounds in an oddball paradigm. Additionally, better communication was associated with longer M300 latencies. ERP data at latencies linked with endogenous auditory processing were associated with more global increased connectivity in NT and increased angulo-temporo connectivity in ASD. Finally, increased angulo-frontal connectivity was associated with longer latencies at exogoneous auditory processing latencies in NT only. Findings suggest differential electrophysiological profiles supported by cortical connectivity and ERPs in ASD and NT associated with PP and communication.

76 **125.076** An fMRI Investigation of Working Memory in Older Adults with Autism Spectrum Disorder: Fronto-Hippo-Striatal-Thalamic Network Differences

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Background: The effects of aging in adults with autism spectrum disorder (ASD) are understudied, but of increasing importance in order to anticipate unique needs of this growing group of individuals. Executive functioning is particularly vulnerable in both high-functioning ASD and in normal aging. Deficits are thought to arise from structural and functional connectivity disturbances between the frontal lobe and posterior brain regions. Recently, a cross-sectional study revealed sharper age-related declines of structural connectivity in adults with ASD, relative to typical adults (Koolschijn et al., 2016). However, differences in functional connectivity disturbances are still unknown; yet, emerging evidence suggests functional connectivity is the best neurobiological predictor of age-related cognitive decline.
Objectives: The current study investigated functional brain network recruitment during an fMRI executive function task in middle-aged men with ASD, compared to age- and IQ-matched typically developing (TD) men.
Methods: Â We evaluated 16 ASD and 17 matched TD men from ages 40 to 64 and of average to high intellectual functioning (IQ: 83-131), For participants with ASD, diagnosis was confirmed via the Autism Diagnostic Observation Schedule-2 and developmental history assessment. TD participants were screened for presence of ASD symptoms via the Social Responsiveness Scale-2. All participants were given the Kaufman Brief Intelligence Test-2. Participants performed the n-back fMRI task, a working memory task that is good indicator of executive function. Participants monitored a series of letters and identified targets that range from simply matching a target ("0-back") to identifying matches that are two letters apart ("2-back"). Functionally connected network activity was assessed via group independent component analysis. Working memory load comparisons were made by the 2 vs. 0 contrasts. Reaction time and accuracy were recorded. Participants performed the task twice.
Results: Â Both groups performed well on all conditions of the n-back task (over 85% accuracy). The ASD participants' reaction time was slower on the 2-back condition, but were similar for accuracy in all conditions. For the working memory load comparison (2 back vs. 0 back), both groups showed similar activation a classic cortical working memory network including the bilateral dorsolateral prefrontal cortex (dlPFC), parietal cortex, insula, and the anterior cingulate cortex, and deactivation the default mode network (DMN). However, only the TD group activated an additional network including the left inferior frontal lobe, and bilateral hippocampi, striatum, and thalamus (Fig. 1a). This working memory activation was significantly greater in TD older adults than older adults with ASD (Fig. 1b).
Conclusions: Â Results showed reduced engagement a fronto-hippo-striatal-thalamic neural network during working memory performance in older adults with ASD, compared to matched TD adults. Dysfunction within this network may underlie working memory and other executive function struggles in high functioning older adults with ASD, and could impact independence as aging ensues. Longitudinal evaluation of differences in age-related cognitive and brain trajectories between older adults with ASD and TD adults are in progress.

77 **125.077** Applying Regionalized Tessellation to Detect Diagnostic Markers of ASD in Resting EEG Data

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Background: Atypical functional connectivity in electrophysiological data is widely reported in individuals with ASD. Existing methods for connectivity analysis include investigating: 1) electrode-to-electrode functional differences and 2) electrode-groupwise differences (cluster based permutation and mass univariate analysis). The first approach results in dense connectivity networks, from which it is difficult to identify regional differences that reliably distinguish diagnostic groups. The second approach relies on finding subsets of electrodes that distinguish groups across empirically simulated distributions. However, this approach, primarily applied to frequency and time-frequency representations of EEG data, is not generalizable to arbitrary features of the EEG, such as variations of phase, complexity, entropy and so on.
Objectives: Our goal was to support identification of diagnostic markers of ASD by developing and applying a permutation-based connectivity approach that was both capable of incorporating arbitrary EEG features and robust to family-wise error.
Methods: Analyses were conducted on two minutes of resting state EEG from participants with ASD (N=73;age=14.2) and TD (N=32;age=12.4). Data were acquired at 1000Hz using a 128-channel Hydrocel Geodesic Sensor Net. Electrodes were assigned to regions based on scalp location, and summarized using any chosen EEG feature. For each investigated (red) region, pair-wise tests on these summaries identify a set of (green) regions that statistically differ from both said region and all non-significant (black) regions. The process is repeated with larger regions until no significant differences are identified.
Results: Our analyses focused on alpha power as the EEG feature of interest. Individuals with ASD showed reduced alpha correlation between right occipital and frontal electrodes, while TD individuals showed a pattern of reduced connectivity among frontal regions. This is shown by clusters of electrodes in individuals with ASD and TD that were significantly different from the region containing electrode E25 (marked as green cube in figures). In ASD, the trio of electrodes E90,E91, and E96 was found to be the main contributor to the observed regionalized significance, while in TD the trio of E62,E67, and E71 was the main source of the statistically significant difference. Two additional regions defined by single electrodes (E61 in ASD and E85 in TD) were also significantly different from the region containing electrode E25.
Conclusions: Our preliminary results support prior findings of reduced long-range but increased short-range connectivity in ASD, and show the utility of the regionalized tessellation methodology for automatically identifying scalp regions that distinguish between diagnostic groups. The strength of this approach lies in its ability to utilize a variety of arbitrary features of the EEG in our analyses. Our ongoing analyses focus on metrics of EEG complexity at the regional and electrode level. These analyses show that regionalized tessellation is capable of identifying established patterns of brain activity that vary between groups, and holds promise for novel investigations of large, high-dimensional data sets.

78 **125.078** Automatic Detection of Emotional Prosody in Children and Adults with Autism Spectrum Disorders

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Background:
Although intolerance of change is a main feature of Autistic Spectrum Disorder (ASD), the brain processes underlying this aspect of the disorder remain poorly understood. This oversensitivity to changes may lead to an inability to adapt to new sensory inputs, and especially to the ever changing social environment. In this respect the processes involved in pre-attentional detection of changes in stimulus features have been investigated in ASD using the mismatch negativity (MMN), an event-related potential that reflects error detection caused by a deviation from a learned regularity. However, although ASD is also characterized by an inability to detect and adapt to changes in emotional states, only few MMN studies in this population have investigated automatic deviancy detection in an emotional context. These studies used different deviant emotions that where always compared to neutral standards, and showed that eMMN was smaller or less lateralized in ASD than in controls. Objectives:
In order to determine if particularities observed in previous studies are related to emotion processing or to change detection abnormalities, the present study addresses direct comparison of automatic change detection of neutral and emotional deviants with strictly controlled acoustic parameters, in children and adults with ASD.
Methods:
Thirty-two adults (16 typical; 16 ASD) and thirty 7-12 years old children (15 typical; 15 ASD) were presented with two voice deviants, neutral (p=.085) and angry (p=.085) (prosodic variation of the vowel 'aaa') embedded in a repetitive neutral stimuli sequence. Brain electrical activity was recorded using a 64-channels Biosemi EEG system, while participants were watching a silent movie. A genuine MMN was measured for each condition as the subtraction of the stimuli presented in an equiprobable sequence from the same deviant stimuli in the oddball sequence.
Results:
Comparisons of age groups and conditions during typical development indicate a late maturation of the brain processes associated with emotional prosody discrimination. Findings in both children and adults with ASD revealed an atypical processing of both emotional and neutral deviancy. In children with ASD, the amplitude of the responses to voice stimuli from the equiprobable sequence were significantly smaller than in controls for both the neutral and the emotional prosody, as where the responses to deviancy (nMMN and eMMN). In adults with ASD responses to voice stimuli were found normal, for both the neutral and the emotional prosody. However the MMN to neutral and emotional deviancy presented atypical brain distributions.
Conclusions:
The detection of prosody deviancy was found altered in children with ASD, together with atypical responses to voice, and this regardless of expression. In adults despite a normalization in voice processing, the detection of vocal deviancy remains affected.
Altogether these findings suggest that voice and prosody processing can improve with age in ASD, but that the lack of expertise in vocal encoding during childhood would lead to a long lasting inability to discriminate between different vocal emotions. This study points to specific difficulty in the online processing of emotional changes in ASD which potentially plays a crucial role in social interaction deficits regardless of age.

79 **125.079** Comparing fNIRS-Based Cortical Activation Patterns during Interpersonal Synchrony Tasks Between Children with and without Autism

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Background: The long-term goal of this research is to determine neurobiomarkers of imitation/interpersonal synchrony in children with and without Autism Spectrum Disorder (ASD) to explain the positive effects of imitation/synchrony-based interventions. Specifically, we will explain the neural basis for how socially embedded, synchronous, whole body movements may facilitate social communication skills in children with ASD.
Mirror Neuron Systems (MNS) in the frontal, parietal, and temporal cortices are active during action observation, production, and imitation (Iacoboni, 2005). The majority of the literature has described MNS dysfunction in children with ASD using fMRI techniques while performing hand motions (Dapretto et al., 2006). For the first time, we will be using functional near-infrared spectroscopy (fNIRS), a novel neuroimaging tool to assess changes in MNS activation across naturalistic interpersonal synchrony tasks.
Objectives: We aim to compare MNS activation across the frontal, parietal, and temporal cortices between children with and without ASD during naturalistic, interpersonal synchrony tasks.
Methods: 12 children with and without ASD between 6 and 12 years of age and 12 healthy adults were seated in front of an adult social partner while they were presented with a circle of blocks. The task involved cleaning up the blocks into a container in 3 ways (Egetemeir et al., 2011): a) *Watch (W)*: the child observed the adult complete the cleanup activity, b) *Do (D)*: the child cleaned up all blocks on their own, and c) *Together (T)*: the child cleaned up all the blocks near him/her along with the adult by matching the block location and color. The cleanup sequence was kept random by the adult to promote social monitoring. 24 trials were collected, 8 per condition using a rnadomized block design. The oxy hemoglobin response of the fNIRS signal was further analyzed to study differences in activation patterns between tasks, between hemispheres, and between the 3 regions of interest.
Results: Our preliminary data suggest more complex MNS activation during the Together (joint action) condition compared to the Do (solo action) or Watch (observation) tasks. Specifically, the temporal cortices showed greater activation during the watch and together conditions compared to the Do condition. In contrast, the fronto-parietal cortices were more active during the Do and Together conditions compared to the Watch condition.
Conclusions: Our results support the use of fNIRS technologies to study cortical activation patterns in children with and without ASD. In the long-term, we will examine the effects of imitation/synchrony-based interventions in children with ASD using MNS-based cortical activation as a neurobiomarker.

80 **125.080** Connectome-Wide Network Analysis of Male Youth with Autism Spectrum Disorder with and without Impaired Self-Regulation

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Background: Individuals with autism spectrum disorder (ASD) commonly present with impaired self-regulatory ability (dysregulation), in affect, cognition, and behavior domains, which would exacerbate social functional impairment in ASD and increase the burden on caregivers. The characterization of dysregulation and its neural correlates in ASD remains elusive and is a priority.
Objectives: Following our earlier structural MRI studies, we aimed to further characterize effects of dysregulation on intrinsic functional connectivity networks in youths with ASD
Methods: We conducted a multivariate connectome-wide association study (CWAS) examining dysconnectivity with resting state functional magnetic resonance imaging in a sample of 52 male youths with ASD, 49 neurotypical male comparators, age range 8-17 years. Dysregulation was defined by the sum of *T*-scores of the Attention, Aggression, and Anxiety/Depression subscales in the Child Behavior Checklist greater than 180. There were 36 and 16 boys with ASD in the ASD+Dysregulation and ASD-Dysregulation groups, respectively. ICA-based strategy for Automatic Removal of Motion Artifacts was applied to address in-scanner head motion. We investigated CWAS differences among the ASD+Dysregulation, ASD-Dysregulation and neurotypical groups. Significant CWAS findings were thresholded at $Z > 1.65$, and controlled for family-wise error rate using Gaussian Random Field (GRF) theory (cluster size threshold $p < 0.05$). Follow-up analyses used the clusters identified by CWAS as the basis for seed-based connectivity analyses.
Results: In CWAS, comparisons of ASD+Dysregulation and neurotypical youths revealed multiple regions where the multivariate pattern of connectivity differed between groups, implicating the dorsal anterior cingulate cortex (dACC) and left inferior frontal gyrus (L-IFG), bilateral precuneus, and right inferior parietal lobule (IPL). Comparisons of ASD-Dysregulation and neurotypical groups showed between-group dysconnectivity in the bilateral sensorimotor cortex. Comparisons of ASD youths with and without dysregulation identified group differences in the left posterior insula. Follow-up seed-based analyses identified increased dACC-bilateral superior temporal gyrus, decreased L-IFG-bilateral precuneus, increased bilateral precuneus-right IPL, increased bilateral precuneus-right IFG/anterior insula, alongside reduced bilateral precuneus-right sensorimotor connectivity in ASD+Dysregulation, relative to neurotypicals. ASD-Dysregulation youths had weaker connectivity between the bilateral sensorimotor cortex and bilateral precuneus/posterior cingulate cortex compared to neurotypical boys. The ASD+Dysregulation group had hyperconnectivity between the left posterior insula and bilateral precuneus/calcarine, between the left posterior insula and left insula, and between the left posterior insula and right supramarginal gyrus, as compared to the ASD-Dysregulation group.
Conclusions: The current findings of distinct intrinsic connectivity patterns in ASD with and without dysregulation suggest ASD with severe dysregulagtion may constitute a distinct subgroup on the spectrum, and the dysregulation level may be a potential yardstick to dissect heterogeneity of ASD. Dimensional neural correlates of dysregulation in ASD based on resting-state functional MRI warrant further investigation.

81 **125.081** Development of a Functional Connectivity Optical Imaging Protocol and Analysis Pipeline for Mouse Models of Autism Spectrum Disorder

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Background: Functional connectivity mapping is a method by which brain function can be non-invasively measured on a whole-brain level using fMRI. Studies of resting-state functional connectivity in autism spectrum disorder have focused on certain developmental stages or on individuals' level of functioning. However, genetic and environmental variation between individuals can introduce added noise to analysis of autism spectrum disorder in humans. Use of mouse models of autism can address this issue of heterogeneity by controlling for genetic and environmental differences. Optical intrinsic signal (OIS) imaging is a minimally invasive, low cost method for mouse neuroimaging, which can map resting-state functional connectivity and cortical activations in response to stimulation in mouse models of ASD and potentially offer insights into brain function in ASD.
Objectives: This study aims to develop functional connectivity optical imaging methods in mouse models of autism and to apply it to pilot groups of genetic or environmental mouse models of autism spectrum disorder (ASD).
Methods: Functional connectivity OIS imaging was performed on two cohorts of mice with autism-related behavioral phenotypes, an SSRI exposure model and a *Celf6* knockout model. In each pilot group, ASD model mice were compared to age-matched wildtype controls by imaging the cerebral cortex of the anesthetized mouse at adulthood, measuring changes in reflected light intensity to calculate relative changes in hemoglobin concentrations. Resting-state functional connectivity and left forepaw stimulation data were collected across multiple runs for each mouse and averaged to produce maps of functional connectivity and variation.
Results: Contralateral homotopic connectivity varied across cortical regions at rest and cortical activation in response to forepaw stimulation varied between mice. A similarity analysis evaluated how similar (spatially) the functional connectivity patterns of the ASD mice were to a control group. No consistent pattern of dissimilarity was found in the ASD groups of mice when measured at adulthood, but a common region of high variability was identified in the individuals of both the ASD groups and controls.
Conclusions: Functional connectivity OIS imaging is a minimally invasive optical imaging method that can be used to map functional connectivity in mouse models of autism. Mapping functional connectivity with these methods in mouse models of autism can control for genetic and environmental differences which may influence imaging research results in humans.

82 **125.082** Distinct Patterns of Auditory Evoked Potentials and Trial-By-Trial Neural Synchrony for Speech and Nonspeech Processing in Children with Autism

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Background: Individuals with autism often display atypical auditory evoked potentials (ERP) (Haesen et al., 2011), which could be due to pathological conditions affecting trial-by-trial neural synchrony (David et al., 2016). Such trial-by-trial neural synchrony to the onset of auditory stimulation can be computed as inter-trial coherence (ITC) for different frequency bands of interest. A smaller ITC could be interpreted as representing larger amounts of neural "jitter". It has been shown that reduced alpha (specifcally at 11.7 Hz) ITC in children with autism may be associated with poorer neuromodulatory control within the sensory cortex (Milne, 2011).
Objectives: This study aimed to verify whether atypical patterns of neural oscillatory activities mediate the auditory evoked responses to speech and non-speech sounds in children with autism.
Methods: EEG data were recorded from school-age Chinese-speaking children with autism and age-matched typically developing (TD) children with a passive listening paradigm. The stimuli were pure tones and Chinese words /bai2/ (Pure tone: ASD *N* = 15, TD *N* = 16; Word: ASD *N* = 14, TD *N* = 15). Amplitude and latency of P1 and N2 (also known as N250 or delayed N1 in children) components were calculated along with the ITC measures of delta, theta, alpha and beta frequency bands within the windows of interest.
Results: In the pure tone condition, there is a significant N2 reduction accompanied by smaller delta ITCs in the autism group. No group difference in the P1 response were observed. In the word condition, the autism group showed enhanced P1 amplitude accompanied by larger delta, theta, and alpha ITCs. There was a tendency (but not statistically significant) of diminished N2 response. In the pure tone condition, P1/N2 responses in both groups were correlated with ITCs, whereas in the word condition, only the autism group showed such relationship.
Conclusions: The comparison with age-matched controls in our study revealed distinct patterns of auditory P1/N2 responses and underlying cortical oscillatory activities for speech and nonspeech processing in children with autism. For the pure tone stimuli, we found evidence for weakened perceptual analysis of acoustic features in the N2 component with reduced inter-trial synchrony in the delta band (0~3 Hz) for the autism group. By contrast, we observed enhanced P1 responses to the speech stimuli accompanied by increased neural synchrony in frequency bands of 0 ~ 30 Hz in the autism group, suggesting a hypersensitive reaction to the word onset in children with autism. It remains unclear how these different patterns of neural activities for early sensory processing of speech and nonspeech sounds might correlate with higher-level behavioral perception. Further studies are needed to examine the potential impact of atypical auditory processing on speech and language development in children with autism.

83 **125.083** EEG Data Collection in Challenging Children: The Role of State in Data Quality and Spectral Power

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Background:
Resting-state EEG is commonly recorded during an eyes-closed condition, free of sensory stimuli. In studies of young children or children with limited cognitive ability, this pure "resting state" is challenging to consistently capture. These children may be unable to follow directions to keep their eyes closed, and require some stimulus in order to remain engaged and calm, thus introducing more variability in state. Child state during the EEG recording may influence both the success of data acquisition and EEG variables (Webb et al., 2015). In order for EEG to be related to clinical relevant traits, this distinction between state and trait must be elucidated. This is especially salient when comparing children with ASD to TD children, who may systematically differ in terms of their state during the EEG recording.
Objectives:
We quantified the "state" of participants (ASD and TD) during EEG recording. We examined how state related to: (1) child characteristics (age, IQ, diagnosis), (2) EEG data quality (percent of data retained), and (3) EEG power, particularly focusing on alpha due to its documented relationship with the resting state, attention and emotion regulation.
Methods:
Participants included a heterogeneous group of children with ASD (N=39) ages 5-10, and an age-matched TD group (N=16). Specific strategies were used to acclimate participants to the EEG testing environment, including modeling, incremental practice and positive reinforcement. Resting EEG was recorded while participants watched a video of bouncing soap bubbles. The state of the participant during the EEG recording was rated using a 5-point likert scale (Perceived State Rating; PSR), where higher scores correspond to higher levels of anxiety/agitation.
Results: EEG data was successfully collected 85% of participants with ASD. Participants with ASD were significantly more likely to have PSR above 1 than TD participants (p=0.002). Percent of EEG data retained was not related to chronological age, verbal IQ or non-verbal IQ. In the ASD group, significantly less data was retained in participants with PSR 2-5 compared with PSR 1 (t=3.22, p=0.003). Using linear regression, PSR significantly predicted percent of data retained (t=-2.69, p=.01), while VIQ, NVIQ and chronological age were not significant (p-values .17-.74). Children in the TD group had significantly higher alpha power compared with children in the ASD group (p-values 0.003-0.036). Within the ASD group, participants with high PSR had the lowest frontal alpha (t=2.49, p=0.02).
Conclusions: Given appropriate supportive strategies, EEG data can be successfully collected from children across cognitive and language levels. The child's state during the EEG recording was significantly related to both the amount of EEG data retained, and alpha spectral power. Alpha suppression has been consistently linked to attention and vigilance (Boiten et al., 1992; Klimesch, 1999), suggesting that reduced alpha power in children with an elevated state rating may reflect that these participants were less "at rest" during the EEG recording. These data highlight the importance of quantifying and addressing state when conducting EEG studies with challenging participants, both to increase data retention rates, and to reduce the influence of state on EEG variables of interest.

84 **125.084** EEG Markers of Learning from Joint Engagement in Toddlers at High Risk for Autism Spectrum Disorder

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Background: Joint engagement (JE), defined as periods of joint attention shared between an adult and infant (Carpenter et al., 1998), emerges between 9-15 months of age (Adamson et al., 2009). JE promotes language, cognitive development and social skill acquisition (Mundy et al., 2007). Children with autism spectrum disorder (ASD) exhibit early social communication deficits including in joint attention (Mundy et al., 2007). Typically-developing toddlers have shown evidence of object discrimination based on JE using electroencephalographic (EEG) methods (Hutman et al., 2015); however, this has not been investigated in toddlers showing early signs of ASD. Examination of object discrimination based on JE in toddlers showing signs of ASD may improve understanding of social communication deficits, which can inform JE-based interventions.
Objectives: (1) To investigate if JE modulates object discrimination in toddlers (12-24 months) at high risk for ASD (HR, n=16) compared to typically-developing toddlers (TD, n=11) using a novel EEG paradigm that couples a live interaction exposure with an EEG test phase. (2) To identify if quality of JE between child and experimenter during the exposure phase relates to EEG markers of learning.
Methods: Toddlers were deemed HR if they scored within the mild-to-severe concern range on the Autism Diagnostic Observation Schedule-Toddler Module. During a 4-minute exposure, the experimenter presented two sets of toys in a social and non-social manner. Child behavior was coded to evaluate quality of JE with the experimenter. Participants then passively viewed images of toys presented during exposure while high-density EEG was recorded (128-electrode, EGI Inc.). The variable of interest was frontal mean Nc (400-800ms), thought to be a marker of attention.
Results: (1) A 3-way mixed-design ANOVA examined main and interaction effects of condition, region, and group. There was no effect of condition by group, $F(1,25)=.004$, $p=.95$. There was an interaction effect of condition by region, $F(2,24)=7.664$, $p=.003$. Post-hoc tests revealed significant differentiation of conditions in the middle region, $t(26)=-2.07$, $p=.049$. (2) Correlations were then conducted to evaluate associations between EEG markers and quality of JE. Time spent looking at the examiner during the social condition correlated with Nc absolute difference value in the middle region, $r(27)=.49$, $p=.01$.
Conclusions: Both HR and TD toddlers show increased familiarity to objects presented with JE. This suggests that toddlers showing early signs of ASD were able to learn via JE with an examiner in a comparable manner to TD children. Given that early intervention for ASD often relies on learning in a social context, these result are promising. The level of object discrimination based on JE, however, varied with regard to social behavior during the exposure phase. Specifically, toddlers who spent more time looking at the examiner during JE showed higher levels of discrimination, indicating salience of object learning may increase with eye contact. Further characterizing child behaviors that relate to learning based on JE may inform intervention treatment targets and predict response to treatment. Future research will aim to relate EEG markers of learning to gains in an intervention focused on improving JE, and to diagnostic outcome of HR toddlers.

85 **125.085** Early Visual Processing of Faces in Tuberous Sclerosis Complex (TSC) and in Children Showing Early Signs of ASD

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Background:
Tuberous sclerosis complex (TSC) is a rare genetic disorder that confers a high risk for autism spectrum disorder (ASD), at a rate of 60% (Jeste, 2013). ASD is characterized by core deficits in social interaction and communication. EEG studies have revealed that children with ASD process faces differently when compared to children with typical development (Dawson, 2002; McCleery, 2009). Therefore, studying socially relevant stimuli, such as faces, may be an adequate way to measure atypical cognitive mechanisms in children with neurodevelopmental disorders, such as ASD and TSC. Not much is known about face processing in children with TSC, nor about how they process faces compared to ASD.
Objectives:
We asked whether EEG correlates of face and object processing differentiated four groups of 12-24 month-old toddlers at risk for ASD: 1. toddlers with TSC who had ASD outcomes (TSC/ASD), 2. toddlers with TSC without ASD outcomes (TSC/noASD), 3. toddlers showing early behavioral signs of ASD (HR) based on elevated scores on the Autism Diagnostic Schedule-Toddler Module (ADOS-T), and 4. low risk controls (LR).
Methods:
A cohort of 7 TSC/ASD toddlers, 11 TSC/noASD toddlers, 24 HR toddlers who scored in the moderate-to-severe risk range on the ADOS-T, and 28 LR toddlers were shown images of faces and objects in a randomized order while high-density EEG was recorded (128-electrodes, EGI Inc.). Event-related EEG components of interest were the N290 (peak amplitude and latency), P400 (peak amplitude and latency), and Nc (mean amplitude).
Results:
There were significant main effects of condition ($F(1,66)=3.86$, $p=.05$) and region ($F(2,65)=9.14$, $p<.001$) for the N290 peak amplitude, as well as significant condition by region ($F(2,65)=5.255$, $p=.008$) and condition by region by group ($F(6,132)=2.589$, $p=.008$) interactions. Post-hoc tests revealed regional differences, showing greater minimum N290 amplitude in the right ($M=5.10$) region than the left ($M=3.57$, $p=.036$). Post-hoc tests also showed differences in condition in the right region within the HR group only, suggesting greater responses to faces ($M=9.15$) than to objects ($M=9.00$, $p=.047$) in early visual processing. For P400 peak amplitude, there were significant main effects of condition ($F(1,66)=8.73$, $p=.004$) and region ($F(2,65)=3.79$, $p=.028$). There was a main effect of condition for Nc mean amplitude ($F(1,66)=24.35$, $p=.001$). There was a significant main effect of group in P400 latency to faces, with slowed processing in both TSC groups (TSC/ASD=446.17ms; TSC/noASD=440.28ms), compared to HR and LR (HR=396.77ms; LR=410.542ms; $p=.002$).
Conclusions:
Condition effects in the three components indicate that there was electrophysiological differentiation of faces and objects across all groups. The HR group showed differentiation in the early visual component N290, which may reflect visual processing mechanisms unique to ASD. The delayed face processing seen in P400 in the TSC group was not specific to ASD diagnosis and, therefore, may reflect a more fundamental delay in processing of social information that could have implications for social skills for all children with TSC. Further investigation of developmental outcomes and correlation of EEG patterns with social communication skills in TSC may shed light on the impact of delayed face processing in this high-risk cohort.

86 **125.086** Electroencephalographic Examination of Resting State Neural Oscillatory Activity in Young Children with Autism Spectrum Disorder

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Background: Previous research has observed atypical neural oscillatory activity in 6-15 year-old children and adolescents with Autism Spectrum Disorder (ASD), using Magnetoencephalography (MEG; Cornew et al., 2012).Â In particular, participants with ASD exhibited regionally specific elevations in delta, theta, alpha, beta, and gamma band activity at rest, relative to controls. Furthermore, increased temporal and parietal alpha power was associated with greater symptom severity in ASD. These findings have been interpreted as evidence for an imbalance in neural excitation/inhibition in ASD.
Objectives: To investigate neural oscillatory activity in younger children with autism using a task-free “Resting State” procedure during continuous Electroencephalography (EEG) recording.
Methods: Participants are children with ASD aged 3- to 5-years ($n=28$) and control participants who were developing typically or experiencing non-ASD developmental delays (CON; $n=25$).Â ASD diagnostic status was assessed by research-reliable doctoral level clinicians using best clinical judgment based on several measures (ADOS-2, Mullen Scales of Early Learning, Vineland Adaptive Behavior Scales). Participants watched a movie (Inscapes) featuring moving abstract shapes without a narrative, designed to keep young participants still and awake (Vanderwal et al., 2015). Continuous 128-channel EEG (Electrical Geodesics, Inc.) was recorded for approximately 7 minutes per participant. Data were then processed offline, and only participants who produced 70 seconds or more of artifact-free data (ASD: $n=17$; CON: $n=19$) were included in further analysis. The final groups of ASD and CON participants were matched on chronological age and nonverbal mental age. Power Spectral Density data were calculated for theta (4 – 7 Hz) and alpha (7 – 11 Hz) activity, for electrodes located over the Orbitofrontal, Dorsolateral Frontal, Central, and Parietal Cortices. ANOVAs with Frequency Band (Theta, Alpha), Region (Orbitofrontal, Dorsolateral Frontal, Central, Parietal), and Hemisphere (Left, Right) as Within-Subjects Factors and Group (ASD, CON) as a Between-Subjects Factor were then conducted.
Results: Significant main effects were observed for Frequency Band ($F(1, 34)=191.957$, $p < .001$, $\eta_p^2=.850$) and Region ($F(2.215, 75.310)=153.733$, $p < .001$, $\eta_p^2=.819$), but not Group ($p=.350$). Significant main effects were moderated by a significant interaction between Frequency Band and Region, whereby power in the Theta and Alpha bands were less differentiated from one another in the Central and Parietal regions than in other cortical regions ($F(1.808, 61.467)=46.098$, $p < .001$, $\eta_p^2=.576$). No other significant main effects or interactions were observed. No significant correlations were observed between parietal alpha power and social functioning in either participant group.
Conclusions: The preliminary findings of this on-going EEG study of young children do not replicate previously observed MEG-based findings indicating atypical neural oscillatory activity in older children and adolescents with ASD. This may be related to differences in the studies, which include the age of the participants (younger versus older), the need to use video watching (versus eyes closed) with the young children in the current study, differences in EEG versus MEG measurement properties, and/or the currently smaller sample size ($n=36$ versus $n=50$) and associated differences in statistical power to detect effects to date in this on-going study.

87 **125.087** Electrophysiological Correlates of Word Segmentation in Three-Month-Old Infants at High and Low Risk for Autism Spectrum Disorder

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Background: Early Auditory Statistical Learning (ASL) – the ability to implicitly extract statistical regularities available in the input (Saffran et al., 1996) – is a precursor to later expressive language ability (Romberg & Saffran, 2010). ASL is crucial for language learning, as it allows infants to detect word boundaries by determining transitional probabilities between syllables in continuous speech (Kuhl, 2004). Successful word segmentation has been demonstrated in 6-month-old infants (Johnson & Tyler, 2010) but no studies to date have examined ASL in 3-month-old infants at high- and low-risk for autism.
Objectives: Here we examined whether EEG signatures of ASL can be quantified at 3-months-of-age, whether different patterns are observed in infants at high (HR: have an older sibling with ASD) and low-risk (LR) for autism, and whether ASL at 3-months predicts later language ability.
Methods: Three-month-old infants (HR:n=17, LR:n=22) were exposed to a continuous speech stream created by concatenating four tri-syllabic artificial "words", constructed from a set of 12 syllables. Infants were then presented with the same tri-syllabic combinations ("words"), as well asÂ tri-syllabic combinations not heard during the exposure phase ("non-words"). High-density electroencephalography (EEG) was recorded (128-electrode, EGI Inc.) and the event-related EEG components of interest included the frontal-auditory P100 and left-temporal Positive Slow Wave (PSW). A general linear model was used to examine within-subject effects of region and condition and between-subject effects of group with respect to P100 maximum amplitude and latency, and PSW mean amplitude. Evidence of word segmentation was operationalized as differences between conditions on PSW. Correlations between EEG markers of word segmentation and verbal ability (receptive and expressive language scales, Mullen Scales of Early Learning (MSEL), 1995), receptive vocabulary (MacArthur Bates Communication Inventory (MCDI), 2007) at 9- and 12-months were also examined.
Results: We observed a significant main effect of group ($F(1,37)=4.59$, $p=.03$) in the frontal P100 latency, with slower P100 peak in HR infants ($M=242.5$) compared to LR ($M=219.4$). With respect to PSW mean amplitude, we observed a significant region by condition interaction ($F(1,37)=3.84$, $p=.05$) and a significant main effect of region ($F(1,37)=4.66$, $p=.03$). Post-hoc tests revealed greater PSW mean amplitude within the left region ($M=2.9$) compared to the right ($M=1.47$, $p=.03$); however, a significant difference between conditions was only observed in the left temporal region only ($t(38)=2.29$, $p=.03$). No significant correlations emerged between P100 frontal latency and MSEL or MCDI measures but the difference in PSW mean amplitude between conditions significantly predicted MCDI words understood at 9-months ($r(25)=.46$, $p=.03$).
Conclusions: Our results indicate differential low-level auditory responses as a function of risk-group, with HR infants showing a delayed P100 compared to LR infants. Moreover, across risk groups, infants as young as 3-months show EEG evidence of ASL as evidenced by the left temporal PSW. ASL at 3-months of age predicted receptive vocabulary at 9-months. Further analyses will examine relations between low-level auditory processing, subsequent language development, and clinical outcomes in infants at high-risk for ASD as well as changes in ASL over the first year of life in both high- and low-risk infants.

88 **125.088** Electrophysiological Markers of ASD in Infants with Tuberous Sclerosis Complex: A Genetics-First Approach to the Search for Predictive Biomarkers

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Background: Tuberous sclerosis complex (TSC) is one of the most commonly-occurring single-gene disorders associated with ASD. Approximately 50% of children with TSC will meet criteria for ASD. Recent evidence has demonstrated striking phenotypic homology in the profile of social communication impairment amongst toddlers with TSC/ASD and toddlers with non-syndromic ASD (Jeste, 2016). In addition, infants with TSC/ASD can be distinguished from infants with TSC no-ASD as early as 12-months of age on the basis of non-verbal cognitive ability. However, there is currently limited understanding regarding the neurobiological mechanisms underlying the development of ASD in TSC. Conversely, animal and human model research has identified characteristic neurobiological aberrations in the context of a TSC mutation, namely in atypical white matter development (including hypomyelination). There is preliminary evidence from older children that these alterations may be most severe in children with TSC/ASD.
Objectives: We aimed to identify potential predictive biomarkers of ASD in TSC in order to inform our understanding of mechanistic pathways to ASD in TSC. Specifically, we examined whether developmental trajectories of electroencephalographic (EEG) power and peak alpha band frequency distinguish infants with TSC/ASD from infants with TSC no-ASD. We examined these specific electrophysiological markers as they have been linked to alterations in white matter development, and hence, may be sensitive to atypical development in TSC in early infancy.
Methods**:** Data reported here form part of a larger, multisite, prospective study of infants with TSC across the first three years of life. We collected high spatial density resting-state EEG recordings from infants with TSC ($n = 40$) and typically developing infants (TD; $n = 32$) at 12, 18, 24 and 36 months. ASD diagnosis at 24 and 36 months was determined using the Autism Diagnostic Observation Schedule and clinical best estimate. We calculated whole-brain relative power in delta (1-4Hz), theta (4-6Hz), low-alpha (6-8Hz), high-alpha (8-11Hz), beta (11-35Hz) and gamma (35-50Hz) bands, as well as peak alpha frequency (between 6-11Hz) for each infant at each age.
Results**:** Mixed-effects models revealed reduced low-alpha power across early development in infants with TSC/ASD compared to infants with TSC no-ASD at all ages ($p < .01$). As a group, infants with TSC exhibited lower relative low-alpha ($p < .001$) and gamma ($p < .001$) power from 12-36 months and reduced peak alpha frequency from 18-36 months compared to TD infants ($ps < .05$). Gamma power at 12 months was positively correlated with non-verbal abilities in infants with TSC ($r = 0.34$, $p = .01$).
Conclusions: Our results suggest that reduced whole-brain low-alpha power across early development may be a neurophysiological signature associated with ASD in TSC. Reductions in peak alpha frequency and relative whole-brain gamma power are associated with TSC as a whole, rather than ASD. Alterations in EEG power and alpha peak frequency are consistent with the characteristic disruptions to white matter development in TSC. Follow-up analyses will examine patterns of neural connectivity and brain-behavior associations to further inform our understanding of cortical alterations associated with ASD in the context of TSC.

89 **125.089** Enhanced Early Visual Responses to Emotional Faces in ASD

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Background:
Sensory atypicalities in all the modalities in ASD have recently gained a crucial role in the description of the autistic symptomatology. In the visual domain, atypical neural responses have been reported in several low- and high- level tasks. Facial expressions, are essential for successful social interactions and represent a core problem for those with ASD. To better understand implicit and rapid processing of emotions in ASD, the visual cortex and emotional network should be considered in neuroimaging studies from its earliest stages.
Objectives:
The present study investigated the time course of brain activity in a large number of regions implicated in various stages of the processing of emotional faces, utilizing both the high spatial and temporal resolution of magnetoencephalography (MEG).
Methods:
Nineteen ASD adults and 19 typically developed adults (TD) took part in an implicit emotional task while MEG was recorded. Stimuli consisted of a face displaying a happy, an angry or a neutral expression and a scrambled pattern presented simultaneously just right and left of central fixation. The participants responded whether the pattern occurred on the left or right side of the screen. Emotions were thus implicit in the task. MEG responses in 23 bilateral regions of interest (ROI) were selected and seven time-windows of 30ms were visually identified to measure mean power. Statistical analyses were performed at each ROI when a deflection was present to investigate group emotion, hemisphere and interaction effects.
Results: Angry faces elicited a stronger response in both groups (110-140ms) in the fusiform gyri (FG), but only the TD presented similar emotional enhancement in the inferior temporal gyri. Hypo-activation in the postcentral gyrus was found in the ASD group to all facial expressions. In the occipital region and the middle temporal poles (125-155ms) the ASD group presented an enhanced activity and an emotion-specific response, while a hypo-activation in the right FG, the bilateral postcentral gyri and in the parietal cortex was found around 155-185ms. Happy faces elicited a greater parietal response in TD (220-250ms) while neutral faces elicited a stronger response than happy faces in the occipital gyri in the ASD (245-275ms). An emotion-specific responses were found (315-345ms) in the FG and in the parietal lobules for both groups. Differences between groups in hemisphere dominance were observed at several ROI and time-windows.
Conclusions:
These results demonstrate a distinct spatio-temporal organization during the processing of implicit emotional faces in adults with ASD. Consistent with perceptual and sensory theories of autism, an early enhancement in the visual cortices was found in the ASD group. Thus, the atypical implicit facial expression processing is not only due to hypo-activation of the FG, but to a broader atypical emotional face network, including atypical visual and emotion-specific responses. According to reports of enhanced visual functioning and to difficulties in configural face processing, a visual bias might be partly responsible for the impairment in the emotional face response in ASD. Thus, our data indicate that atypical early visual responses should be considered while investigating social cognition in autism.

90 **125.090** Enzyme Kinetics of N-Acetyl-Aspartylglutamate in the Cingulated Cortices in ASD: A 1H-MRS Model

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Background: The L-glutamate (Glu) and L-acetyl-aspartate (NAA) are products of N-acetyl-aspartyl-glutamate (NAAG) which require the participation of neurons, oligodendrocytes and atrocytes. On the one hand, NAAG is synthesized from NAA and Glu by an NAAG synthase, forming a dedicated pool of Glu that also cannot be further metabolized, and on the other hand, NAAG is then hydrolyzed by NAAG peptidase releasing Glu which activates the mGluR3 receptor. Enzymes stabilize transition states for reactions, and thus lower the activation energy required. A common measure for how much a reaction is sped up is called the rate enhancement, equal to the ratio of the catalyzed rate to the uncatalyzed rate. This ratio varies widely, ranging from one (which is technically no longer an enzyme - merely a protein) to 1.4×10^{17} for oritidine-monophosphate decarboxylase (an enzyme involved in DNA synthesis). At high concentrations, some substrates also inhibit the enzyme activity. Substrate inhibition occurs with about 20% of all known enzymes. It happens when two molecules of substrate can bind to the enzyme, and thus block activity. Altered NAAG metabolism has been described, in some neurological conditions but not in autism spectrum disorders (ASD). Our previous studies using proton-Magnetic Resonance Spectroscopy (^{1}H-MRS) in bilateral anterior (ACC) and posterior cingulate cortex (PCC) have described the altered neurometabolic patterns in adults with ASD.
Objectives: To study the enzyme kinetics of NAAG in vivo, using ^{1}H-MRS.
Methods: Single-voxel (^{1}H-MRS) in bilateral ACC and PCC, in 19 adults with a clinical diagnosis of ASD and 41 controls, matched for age, gender. Autism quotients (AQ) score were assessed. The affinity between enzymes and substrates associated with NAAG was measured. The Michaelis-Menten constant is calculated. One-way ANOVA and Bonferroni correction were applied.
Results: The ASD group had a significant increase of K*m* (NAA) = [5,79x10^6 (mM)]; R^2 = -27.05 compared with controls (TD) in ACC.
Conclusions: Altered enzyme kinetics N-acetylaspartylglutamate levels were found in cingulated cortices by ^{1}H-MRS in individuals with ASD, suggesting new therapeutic avenues.

91 **125.091** Evaluating the Neural Correlates of Intention Understanding in Autism Spectrum Disorder

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Background: Â Deficits in high level social cognitive skills such as joint attention and theory of mind are well documented in children with Autism Spectrum Disorder (ASD). However, the behavioral literature is equivocal to whether children with ASD have the ability to engage in lower level social cognitive skills such as recognizing others as acting intentionally. These equivocal findings may be partially explained by the varying methodology used to assess the construct termed 'intention' across studies. When children with ASD are simply required to attend to actions on an object to infer another's intention, studies reliably find intact intention understanding abilities. In contrast, when tested using paradigms that require children with ASD to attend to social-communicative cues (e.g., facial expressions, gaze, etc.) to draw conclusions regarding intention, impairment in intention understanding is identified. This study uses Event-Related Potentials (ERPs), a measurement of brain activity with millisecond resolution, to build upon the behavioral literature to better understand how different types of intention are processed at a neurological level in individuals with ASD.
Objectives: The purpose of this study was to use ERPs to assess, for the first time, the neural correlates of intention understanding in children with ASD and controls. Given behavioral research suggesting that ASD is associated with impaired intention understanding only when cued using social stimuli (e.g., facial expressions, gaze, etc.), this study compared differences in neural processing between groups across social and non-social stimuli.
Methods: We examined neural indices of social and non-social intention understanding in 22 school-age ASD children and 22 controls (age, gender, and IQ matched). Participants viewed picture sequences depicting either social or non-social intention. The final picture of the sequence varied such that an actor either completed the intended action (expected) or performed an unintended action (unexpected). We evaluated the P600 as it has been linked to expectancy violations in visual scene processing. Participants made button press responses to intended condition only.
Results: *Social stimuli:* Both groups demonstrated similar ERP responses, characterized by a greater (positive) P600 to unintended vs. intended condition. Response accuracy was significantly worse for the ASD group. *Non-social stimuli:* No group differences were identified in either response accuracy or ERP responses (greater P600 to unintended vs. intended condition).
Conclusions: Accuracy data concord with previous behavioral findings of a dissociation between social and non-social intention understanding, such that social intention alone is functionally impaired in ASD. However, no group differences were observed for either stimuli type at a neurological level. This is a particularly novel finding, as it demonstrates that observed behavioral impairments are independent from the neural processes supporting basic social intention understanding. Additional work is necessary to characterize this newly identified gap between neurological functioning and overt behavior.

92 **125.092** Event-Related Potentials Index Atypical Processing of Auditory Tones in Young Children with Autism Spectrum Disorder

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Background: Magnetoencephalography (MEG) studies have identified atypical processing of simple tones as a putative biomarker associated with Autism Spectrum Disorder (ASD). Specifically, participants with ASD exhibit temporal delays and hemispheric differences emanating from superior temporal gyrus between 50 and 100ms post-stimulus, and reduced activity at approximately 200ms post-stimulus, relative to controls. Furthermore, these differences are associated with language abilities in ASD. However, these findings have yet to be replicated using other measures, such as electroencephalography (EEG) based event-related potentials (ERPs). EEG and MEG are highly similar in their millisecond-level temporal resolution, yet different in that MEG has generally greater sensitivity to brain activity source locations with the limitation of being relatively insensitive to radially oriented brain activity.
Objectives: To investigate the neural correlates of simple auditory tone processing in children with ASD using EEG-based ERPs.
Methods: Participants are children with ASD aged 3- to 5-years (n=14) and chronological age and nonverbal mental age matched typically developing (TD) children (n=14). Auditory stimuli consist of 400ms long 200 Hz, 600 Hz, and 1000 Hz sine tones, presented at 70dB. The current analyses focus on the N200 and P200 components recorded over temporal and frontal cortex, respectively. ANOVAs with Frequency (200 Hz, 600 Hz, 1000 Hz) and Hemisphere (N200: Left, Right; P200: Left, Medial, Right) as within-subjects factors and Group (ASD, TD) as a between-subjects factor were conducted on the amplitudes and latencies of these components. Correlations between component latency and an index of language delay were also computed.
Results: P200 latencies exhibited a Frequency by Group interaction over frontal cortex ($F(2, 25) = 4.70$, $p < .05$, $\eta_p^2 = .273$), whereby latencies in the Medial region were shorter in ASD participants for 200 Hz (ASD: 174ms; TD: 187ms) and 600 Hz (ASD: 156ms; TD: 167ms) tones, but longer for ASD participants for the 1000 Hz tone (ASD: 163ms; TD: 153ms). No other significant Group effects were observed. P200 latencies were also negatively correlated with degree of language delay for the 200 Hz ($r = -0.575$, $p < .05$) and 600 Hz ($r = -0.601$, $p < .05$) tones in the ASD group.
Conclusions: The preliminary ERP findings of this on-going study replicate the general finding of atypical auditory perceptual processing for simple tones in ASD, albeit with a different pattern than that observed in previous MEG studies. Differences in the measurement properties and capabilities for MEG and EEG may explain the different patterns in the data. Alternatively or additionally, the age of the participants (younger in the current study) may help explain the differences. Regardless, the replication of an ASD versus TD group level difference in simple tone processing as well as correlation of more atypical tone processing with language delays in the ASD group, strongly suggest that the current EEG study findings reflect sensitivity to the biomarker previously identified using MEG. Together, EEG and MEG studies have potential to provide more detailed characteristics and explanations for atypical tone processing in infants, children, and adults with ASD.

93 **125.093** Frontal EEG Asymmetry As an Early Marker of Behavior Vulnerability in Infants with Congenital Visual Impairment Who Are at Risk of Autism Spectrum Disorder (ASD)

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Background: Young children with congenital visual impairment (VI) are at increased risk of behavioral vulnerabilities. Previous literature on other clinical 'at risk' populations including young children with autism spectrum disorder (ASD) suggests that frontal electroencephalogram (EEG) asymmetry may be a marker of risk in temperament and behavior. *Objectives:* This study set out to investigate frontal EEG asymmetry at one year of age, behavior patterns at two years of age and their predictive associations. *Methods:* At Time 1, 22 infants (mean age 13 ± 2.5 months) with 'potentially simple' congenital disorders of the peripheral visual system underwent 128-channel EEG recording whilst being presented with happy, sad and neutral vocalizations. Frontal EEG asymmetry ratios were calculated from power spectral density values in the alpha frequency band (6-10 Hz), and a composite frontal EEG asymmetry score was derived. At Time 2, when the infants were approximately 2 years old, parent-rated behavior questionnaire (Achenbach Child Behavior Checklist) data was obtained. *Results:* The majority of the sample (63.6%) had greater left frontal asymmetry; 22.6% of the sample had clinical/subclinical range 'internalizing' behavior difficulties. Infants with the lowest vision levels (towards light perception at best or no vision) had significantly higher scores in the direction of behavior problems, specifically for Withdrawn problems. Longitudinal correlational analyses revealed a significant association between EEG frontal asymmetry and behavior, whereby greater left frontal asymmetry correlated with greater internalizing (emotionally reactive) problems. *Conclusions:* The finding of greater left frontal asymmetry in this sample of young children with VI is consistent with reports of greater left frontal asymmetry in other 'at risk' clinical populations including ASD (Gabard-Durnam *et al*., 2015). Our findings suggest the existence of a potential early electrophysiological marker of behavioral difficulties in young children with VI and later VI-ASD diagnosis, which is currently being explored.

94 **125.094** Impulse Control Is Differentially Modulated By Social Versus Non-Social Stimuli

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Background: Extensive research has shown that typically developing individuals show a bias in impulse control towards faces. In autism, prior work has also shown increased impulsivity towards happy faces. However, it is unknown whether other types of salient cues, such as hobbies or interests, elicit a similar bias.
Objectives: The aim of this study was to investigate impulse control and underlying neural mechanisms towards different types of salient stimuli in typical development to provide a foundation for future studies in autism. We expected participants would show a similar bias towards interests as they do towards social stimuli.
Methods: Forty typically developing adults (17 females) aged 23.4 (± 3.3) years performed a novel go-nogo task during fMRI. For the social conditions, participants were presented with happy and calm faces. For the interest conditions, participants chose their favorite (interest) and least favorite hobby/activity (non-interest) from 23 options. There were 5 runs of go-nogo pairs (blue vs. yellow, happy vs. calm, calm vs. happy, interests vs. non-interests, non-interests vs. interests). Participants were instructed to press to the target cue (go) when it appeared on screen and not press to the distractor cue (nogo). False-alarm rates were calculated as the number of erroneous button presses to the nogo cue in each of the five conditions.â€¨D-prime was calculated as the normalized hit rate (go-accuracy) – normalized false alarm rate. We used ex-Gaussian distribution parameters to characterize fast (mu and sigma) and slow (tau) reaction times (RT's).
Results: Go-accuracy did not differ between conditions, showing participants attended to the different conditions equally well. Linear mixed-effects model analysis showed main effects for false-alarm rate (p = .006), d-prime (p = .006), reaction times to go-stimuliÂ (p < .001), and the ex-Gaussian parameters mu (p < .001), and sigma (p < .001). Participants showed highest d-prime, lowest false alarm rate, and fastest RT's to colors. There were no differences between calm and happy faces on any of the measures however; d-prime was significantly higher for interests compared to non-interests (p = .042), suggesting increased control towards interests. To assess an overall bias for social stimuli, comparing the collapsed social stimuli (faces) against the collapsed objects (interests/non-interests), showed d-prime was lower (p = .024) for social stimuli. Ex-Gaussian parameter mu also showed slower reaction times (p< .001) towards social stimuli. As expected, dorsolateral prefrontal cortex (dlPFC) showed heightened activation during inhibition. We will further investigate how cognitive control networks are modulated by distinct salient stimuli.
Conclusions: As expected, typically developing adults were more impulsive towards social stimuli. Interestingly, the difference in d-prime between social and non-social stimuli was driven by higher d-prime towards interests, suggesting that, in contrast to our hypothesis, one's interest facilitates inhibition. Together these findings show impulse control is differentially modulated by distinct salient stimuli, which may be important for individuals with autism, where stimuli associated with their interests may interfere during impulse control. Future work examining the neural underpinnings of impulsivity to salient cues will constrain interpretations of the behavioral data.

95 **125.095** Increased Connectivity of Voice Processing Brain Networks in Females with Autism: A Preliminary Study of Gender Differences in ASD

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Background:
Autism spectrum disorders (ASD) are poorly understood in females. The incidence of autism is greater in males, but it is unknown whether this disparity is due to actual occurrence rate or a bias in diagnosis; the criteria for diagnosing ASD has been developed using data almost exclusively from studies of males, and symptoms of ASD often manifest differently in females. Some believe that, due to genetics and environmental factors, females are more likely than males to have characteristics that help them compensate for and mask symptoms of ASD.
Autism is characterized by a lack of engagement with social cues, a primary of which is speech. We have developed a model of human voice processing composed of the core voice processing system, anchored in the superior temporal sulcus (STS), and an extended voice processing network, encompassing reward and affective areas. Previous research in our lab has shown that children with ASD show underconnectivity between core and extended voice processing networks; however, it is unknown whether connectivity of the voice processing system in ASD varies across genders.
Objectives:
The objective of this study is to examine gender differences in connectivity of voice processing brain systems in high-functioning ASD.
Methods:
15 females and 15 males with high-functioning ASD (8-16 y/o) were matched on age, IQ, ADOS Social Affect score, and head motion in the scanner. All participants underwent resting-state fMRI scans. In addition, participants were administered an extensive battery of questionnaires and clinical and cognitive assessments to determine IQ and ASD diagnosis. Functional connectivity analyses were used to examine between-group differences in connectivity for bilateral posterior and anterior STS (i.e., core voice processing network) seeds.
Results:
Compared to males with ASD, females with ASD demonstrated increased connectivity between nodes of the core voice processing network and a wide array of brain systems, including (1) reward and affect processing regions, including the nucleus accumbens, ventral tegmental area, orbitofrontal cortex, and amygdala, (2) canonical language processing regions, instantiated in middle and superior temporal cortex, inferior frontal gyrus, and angular gyrus, and (3) key nodes of the salience network, including dorsal anterior cingulate and anterior insula. No voxels were greater for males compared to females with ASD.
Conclusions:
Preliminary results suggest that compared to males with ASD, females with ASD demonstrate increased connectivity between the core voice processing network and an extended network of brain regions, including regions implicated in reward, affective, language, and salience processing, providing initial indication that females and males with ASD may in fact utilize different brain mechanisms for processing social cues. Further analyses and larger participant samples are needed to properly investigate the interaction between gender and diagnosis and the role this interaction plays in connectivity patterns of voice processing brain networks.

96 **125.096** Investigating Reward Processing in the Longitudinal European Autism Project (LEAP) Cohort with Fmri

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Background:
Studying reward processing in autism spectrum disorder (ASD) has so far yielded inconsistent results. Some previous studies have proposed impaired reward processing in ASD specifically regarding social reward, while others proposed a general reward processing deficit across social and monetary reward types, possibly differentiating ASD from other disorders. However, current evidence does not clearly support either of these hypotheses. This likely reflects the heterogeneity of the disorder, which has been insufficiently addressed due to small sample size, along with the unknown reliability of the measures.
Objectives:
To address these issues, the Longitudinal European Autism Project (LEAP) is using functional magnetic resonance imaging (fMRI) during reward processing (for general aspects of multi-site fMRI assessment and effects of all applied tasks see abstract by Moessnang et al.) alongside an extensive cognitive and neuropsychological task battery in a large cohort of patients with ASD as well as typically developing (TD) subjects.
Methods:
A social and a monetary reward processing task were designed, as part of a comprehensive fMRI task battery which allows for the inclusion of participants across a broad age and ability range (including those with mild intellectual disabilities). FMRI was performed at six European centers following standard operations procedures. A total of 635 subjects completed the social and 565 subjects completed the monetary reward task, with an overlap of 562 subjects completing both reward processing tasks. Subjects were aged 6-30 years, with 53% ASD and 69% male participants. Baseline assessment was performed between April 2014 and September 2016. First pass analyses have been performed using standard processing routines implemented in SPM12 (http://www.fil.ion.ucl.ac.uk/spm/).
Results:
Preliminary statistical analyses based on the General Linear Model revealed robust activation of the network of interest, while simple case-control differences did not pass the significance threshold ($p<0.05$, family-wise error corrected across the whole brain). However, region of interest (ROI) analysis of the ventral striatum yielded hypoactivation of the right ventral striatum in ASD patients during monetary reward anticipation ($F(1,430)=5.447$, $p=.020$) but not during social reward anticipation ($F(1,501)=2.249$, $p=.134$).
Conclusions: The LEAP cohort represents the largest European task-based fMRI data set on autism. The employed tasks proved reliable and successfully engaged functional activation of the reward processing circuit both during monetary and social reward anticipation. In line with some previous smaller studies, ROI analysis of ventral striatal activation yielded a significant difference between ASD patients and TD subjects during monetary reward, while there were no effects on the whole brain level. However, further thorough investigation of different sources of variance, including direct social/monetary task comparisons, between-site differences, symptom profiles and developmental effects, is required. Further, the analysis of functional activation during reward receipt, as well as connectivity-based measures may aid in deeper understanding of the autism phenotype.

97 **125.097** Measurement of Autistic Children's Brain Responses with Emotiv EEG

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Background: The Emotiv EPOC is a cheap, portable, wireless electroencephalography (EEG) headset designed originally for the computer gaming market. Set-up time is quick (approximately 5 minutes) and simply involves adjusting the position of 16 saline-soaked cotton pads on the participant's scalp. Recently, we have adapted the Emotiv system to record event-related potentials (ERPs) to visual and auditory stimuli. In validation studies with typically developing children and adults, we have shown that ERP waveforms measured using the Emotiv system are comparable to those recorded simultaneously using a research-grade NeuroScan EEG system (Badcock et al., 2013, 2015).
Objectives: In this study, our aim was to determine the feasibility of the Emotiv system for use with children on the autism spectrum
Methods: We tested nine 8- to 12-year-old autistic children on an auditory oddball task in which they listened to sequences comprised of 85% standard tones (1000 Hz) and 15% deviant tones (1200 Hz). Brain responses recorded using the Emotiv EEG system were compared to those of age-matched typically developing children tested using identical procedures as part of our validation study (Badcock et al., 2015).
Results: All nine autistic children were able to tolerate the testing procedures. The prominent N1 and P3 responses to the standard tone were comparable to those of typically developing children. Autistic children also showed a clear mismatch negativity, calculated as the difference between responses to the standard and deviant tones.
Conclusions: Results provide preliminary validation of the Emotiv EEG system for autism research. The rapid set-up time and comfort of the headset make it especially suitable for studies of children whose sensory issues might mean they were unable to participate in EEG research. Given its low cost, portability, and ease of use, the Emotiv system could also be used in clinical settings and in large-scale, multi-centre studies looking for EEG markers of autism subtypes.

98 **125.098** Mu Rhythm Suppression Reflects Mother-Child Face-to-Face Interactions: A Hyperscanning MEG Study

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Background:
Spontaneous face-to-face interactions between mothers and their children play crucial roles in the development of social minds. However, these inter-brain dynamics are still unclear. To better understand the inter-brain dynamics that occur during human interactions, it is necessary to research not only a single brain in isolation but two brains during a real interaction. Simultaneous multiple brain functional measurements may reveal the brain dynamics underlying social interactions.
Objectives:
We measured the mu suppression during face-to-face spontaneous nonverbal interactions between mothers and their children with autism spectrum disorder (ASD) using the dual magnetoencephalography (MEG) system.
Methods:
Fourteen children with ASD and their mothers participated in this experiment. They were diagnosed by a clinical psychiatrist and a clinical psychologist with more than 5 years of experience in ASD using the Autism Diagnostic Observational Schedule–Generic (ADOS), the Diagnostic Interview for Social and Communication Disorders (DISCO), and the DSM-5 criteria at the time that they entered into this study. We used a 160 channel MEG (MEG vision NEO, Yokogawa Electric Corporation) and a 151 channel MEG (PQ1151R, Yokogawa Electric Corporation/KIT). These MEG systems were housed in a magnetically shielded room. To measure the mother-child interactions in a face-to-face situation, we set up a real-time dual video presentation to show the facial expressions of the mother and child. Short movies and the other's facial expression with a live movie or a still picture were alternately displayed for 10 or 15 sec, respectively, on the half-mirror screen, while simultaneous, neuromagnetic recordings of their brain activities were performed.
Results:
The results demonstrated significant correlations between the index of mu suppression (IMS) in the right precentral area and the traits of ASD in 13 mothers and 8 children (Data from some children and a mother could not be obtained due to artifacts). In addition, higher IMS values (i.e., strong mu suppression) in mothers were associated with higher IMS values in their children. To evaluate the behavioral contingency between mothers and their children, we calculated cross correlations between the magnitude of the mother and child head-motion during MEG recordings. As a result, in mothers whose head motions tended to follow her child's head motion, the magnitudes of mu suppression in the mother's precentral area were large.
Conclusions:
Our results from this study demonstrated that the mu suppression level of ASD children and their mothers reflects their social ability or autistic traits and demonstrated a correlation between the mu suppression in the mothers and their children. Further studies with larger sample sizes, including both typically developing children and children with ASD, are necessary to test the reliability of these findings and support their generalization to interactions between typically developed mothers and typically developing children.

99 **125.099** Neural Correlates of Affective Processing in Adults with Autism Spectrum Disorder

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Background: The ability to perceive and interpret emotional faces, integral to successful social functioning, has been found to be impaired in ASD. Magnetoencephalography (MEG) is a non-invasive neuroimaging modality that provides high spatio-temporal resolution of neural activity. Previous MEG studies have shown atypical neural activity during affective face processing in youth with ASD but no studies to date have examined the neural substrates of this ability in adults with ASD.
Objectives: The present study explored the temporal and spatial properties of MEG activation during implicit angry and happy face processing in young adults with and without ASD. We hypothesized that adults with ASD would show atypical activity, particularly in social brain areas.
Methods: We recruited 52 young adults (ASD group: N=26, 8 females, 26.3+4.2 years; Control group: N=26, 8 females, 26.3+4.1 years) to complete an emotional face processing task in the MEG. Participants were presented rapidly (80ms) with an emotional face (happy or angry) concurrently with a scrambled pattern (target) on either side of a central fixation cross. Using a response button box, participants indicated the location (right or left) of the target by pressing the appropriate button. A 3T structural MRI was obtained for each participant for co-registration with MEG data for accurate source localisation. SPM12 was used for MEG data pre-processing and analysis. Empirical Bayes Beamformer estimated activation sources related to happy and angry face processing.
Results: Happy and angry faces elicited greater activation in adults with ASD, relative to controls, in a number of areas including bilateral inferior temporal gyri, bilateral fusiform gyri, and left parahippocampal gyrus. Adults with ASD also showed greater activity in key social processing areas such as the right anterior insula and anterior cingulate cortex. Of particular interest was our finding that, to angry faces specifically, adults with ASD showed greater right amygdala and left superior orbital activity, relative to controls. In contrast, in controls, angry and happy faces elicited greater, relative to adults with ASD, activity in areas including sustained activity in the left cuneus/precuneus and the right post-central gyrus. Furthermore, within group analyses showed more scattered activation patterns to both happy and angry faces in adults with ASD, compared to controls.
Conclusions: This study is the first to provide evidence of distinct patterns of atypical activation to happy and angry faces in adults with ASD using MEG. Differences in neural activity between young adults with and without ASD indicate atypical processing in neural areas involved in face perception, affect processing, threat processing, and emotion processing and social reward may account for deficits in atypical emotional processing in adults with ASD. Within group results suggest adults with ASD show more disorganised processing of emotions. Thus, atypical recruitment of neural regions may contribute to deficits in affective processing early on in young adults with ASD.

100 **125.100** Neural Correlates of Hand Gesture Imitation in Children with Autism Spectrum Disorder

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Background: Motor skill and motor planning impairments are frequently observed in children with ASD, which is associated with impaired acquisition of social communication skills linked to poor imitation learning. Learning an action requires integration of sensorimotor information and encoding models to replicate the action and understand those actions when performed by others. Learning skilled gestures is particularly reliant on integration of visual and proprioceptive input, and may provide critical developmental foundations for social communication. Exploring the diagnostic differences in imitation and motor planning may provide insight into mechanisms of social communication deficits.
Objectives: We used a gesture imitation task to examine the neural correlates of motor planning and to investigate whether differential neural patterns of motor planning during imitative learning exist between typically developing (TD) and high functioning children with autism (HFA).
Methods: fMRI data were collected on 22 subjects, HFA (*N=10*) (9M, 10.89+/-1.20 years) and TD children *(N=12)*(9M, 10.29+/-0.98 years). Participants were trained to imitate a series of 14 videos of novel meaningless-gestures performed by an actor using her left hand, establishing a similar level of performance crucial for investigating diagnostic differences. Participants were instructed to observe the gesture, plan how to copy, copy the gesture with their right hand (mirror image), and rest, according to trained colour cues.
Results: Behavioural analysis showed comparable gesture accuracy performance between groups (HFA: 77.8%±8.00; TD: 85.7%±7.14, p=.972). Preliminary analyses reflect significant effect of diagnosis at the p<0.001 level using a 10 voxel cluster-level threshold. In the observe condition greater activation in bilateral sensorimotor areas was observed in the HFA group than the TD, although the difference was more apparent in the right hemisphere. In the plan condition, it was the TD group that shows greater activation in the postcentral gyrus. In copy condition, there was greater activation for the HFA group localized to the left posterior cingulate gyrus, the right parahippocampus and anterior insula, whereas TD showed greater activation in V3.
Conclusions: While behavioural analyses demonstrated comparable gesture imitation, imaging analyses revealed significant group differences in the neural activation during observation, motor planning and execution. During observe, the HFA children recruited areas in the right somatosensory region relating to the left hand not seen in the TD group. The TD children showed recruitment of similar sensorimotor areas when required to plan the gesture, but in the left hemisphere, recruiting areas related to the right hand, used in copying the gesture. This differential recruitment in timing and hemispheres suggests that HFA children may have a delayed visuomotor transformation, initially encoding the anatomical hand (left) before transferring to the mirror hand (right). In copy, the posterior cingulate gyrus, involved in motor imagery tasks, is recruited in the HFA group, indicating mental imagery processing that is not apparent in TD children. These results suggest differential motor planning processing in imitative learning in children with autism, and may help to explain behavioural observations of autism-associated impairments in imitative skills. Further study needs to be done to explore possible differences in imitative encoding timecourses in autism.

101 **125.101** Neural Correlates of Olfactory Dysfunction in ASD: Preliminary Results

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Background: Sensory abnormalities are prevalent in autism spectrum disorder (ASD) and may be an important predictor of ASD severity in various domains of dysfunction. Although olfaction is not the most commonly affected sense in ASD, atypical olfactory processing is the most predictive of ASD severity and is more prevalent in ASD than in other neurodevelopmental disabilities. Despite its shared neural substrates with primary emotion areas including the amygdala and orbital frontal cortex (OFC), the olfactory system is under-studied in fMRI research in relation to other sensory systems.
Objectives: To gain further understanding of the neural basis behind olfactory processing differences in ASD we hypothesized that school-aged children with ASD would exhibit increased activation of primary and secondary olfactory areas (OFC, amygdala, piriform cortex) compared to typically developing (TD) children and children with sensory processing challenges without ASD (SPC). Our second hypothesis was that greater Blood-Oxygen-Level Dependent (BOLD) responses in primary and secondary processing areas, independent of diagnosis, would be related to poorer olfactory function.
Methods: Â Eight children with ASD (Age M = 11.24, SD=1.6), ten typically developing (TD) (Age M = 9.61 SD=1.34) and eleven children with sensory processing challenges (SPC; Age M = 10.61 SD=1.5) were studied. Olfactory function was tested using the University of Pennsylvania Smell Identification Test (UPSIT). T1-weighted 3DMPRAGE and fMRI data were acquired on a 3T Philips Achieva scanner. During the fMRI, we exposed our participants to a rose-like odorant (phenyl ethyl alcohol), in four, 9 second blocks separated by at least 30 second intervals of air using a respiration-triggered odor paradigm. We tested for whole-brain group differences in activation in response to olfactory stimuli, and compared the relationship between brain activation and olfactory function using a fixed-effects model in FSL's FEAT Software.
Results: Â Participants with ASD yielded significantly greater OFC activation than TD participants (ASD>TD: Left OFC, *Z*-Max = 4.69, *p*=0.0085; Right OFC, *Z*-Max = 5.31, *p*<0.001; Figure 1A) as well as participants with SPC (ASD > SPC: Left OFC, *Z*-Max = 5.27, *p*<0.001; Right OFC, *Z*-Max = 5.34, *p*<0.001; Figure 1B). No significant group differences were observed in the amygdala or piriform cortex. We found a negative correlation between OFC activation and UPSIT score across the groups (Left OFC, *Z*-Max = 4.61, *p*=0.0017; Right OFC, *Z*-Max = 5.34, *p*=0.0014; Figure 2).
Conclusions: Children with ASD displayed greater bilateral OFC activation than children in both comparison groups, partially supporting our first hypothesis of ASD hyperactivation in olfactory areas. Additionally, we found a relationship between greater OFC activation and poorer olfactory function. Together, these results highlight the possibility that measures of olfactory functioning are sensitive to OFC dysfunction in ASD, which is consistent with the OFC's role in odor identification. Further, these results indicate that our method shows promise as an early diagnosis biomarker, as odor perception can be measured safely using fMRI with neonatal subjects. Data collection is ongoing and we aim to validate the current preliminary findings and further characterize the role of OFC dysfunction, as well as related neural circuitry, in ASD.

102 **125.102** Neural Mechanisms Underlying Visuospatial Expertise in ASD

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Background: Â Visuospatial strengths have been well documented in a large proportion of individuals with autism spectrum disorders (ASD). Brain mechanisms underlying visuospatial abilities have been investigated in previous studies, revealing higher activation in occipito-parietal regions and diminished activation in some frontal regions in ASD (Kana et al., 2013; McGrath et al., 2012; Silk et al., 2006). However, no such studies have investigated the brain correlates underlying superior visuospatial abilities in distinct subgrouping of ASD individuals based on their visuospatial abilities.
Objectives: Â The principal goal of this study was to uncover the neural network involved in visuospatial abilities and expertise in ASD in different subgrouping based on their Wechsler Block Design subtest's performance using functional magnetic resonance imaging (fMRI) technique.
Methods: Forty ASD male participants, 20 of them having enhanced visuospatial skills (defined as relative strength on Block Design subtest) (Wechsler, 2008), and 20 non-ASD male participants (age 18-37) matched on age and IQ will perform two visuospatial tasks in the fMRI scanner. The first task is an adaptation of the original Block Design subtest (BD) suitable for presentation in the MRI scanner. Perceptual cohesiveness of the target design is parametrically varied across the 90 trials. The second task is a classic mental rotation (MR) task with three-dimensional shapes. 104 pairs of images were presented with four different spatial orientations (0, 70, 140 and 180 degrees). Both tasks are presented in an event-related design, with percentage of correct responses and response time recorded. Preliminary results include 23 ASD participants, 10 of them having enhanced visuospatial skills, and 16 non-ASD subjects.
Results: Despite no differences in accuracy and response time across the three groups, ASD participants displayed greater activity in anterior prefrontal cortex (PFC) in both tasks compared to non-ASD participants. Furthermore, the MR task revealed higher activation in superior and inferior frontal gyri, superior parietal lobule and cerebellum in ASD participants compared to non-ASD participants, whereas the adapted BD subtest revealed higher activation in the right superior and middle temporal gyri and the left anterior cingulate gyrus in ASD participants. Non-ASD participants showed higher activation in supplementary motor area, and in primary motor and sensory areas in the MR task. Further analyses compared the brain correlates of ASD with and without superior visuospatial abilities. Higher activation in bilateral ventrolateral PFC was observed in the ASD group without superior visuospatial abilities while performing the adapted BD task, whereas higher activation in some occipital, parietal and temporal regions was observed for the ASD group with superior visuospatial abilities during the MR task.
Conclusions: Our preliminary results are inconsistent with previous results showing lesser activation in some frontal regions in ASD while processing visuospatial information (McGrath et al., 2012). Furthermore, despite equivalent performance, increased parietal and occipital activity in ASD individuals with superior visuospatial abilities compared to those without may suggest enhanced functional resource allocation in regions dedicated to visuospatial processing and expertise. Diminished prefrontal activity in ASD individuals with superior visuospatial abilities may suggest more efficient visuospatial processing requiring less cognitive control resources.

103 **125.103** Neural Mechanisms of Social Prediction Errors in Adolescents with ASD

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Background: This study investigated the neural mechanisms of social prediction errors using functional magnetic resonance imaging (fMRI) in adolescents with and without autism spectrum disorder (ASD). Prediction errors occur when outcomes differ from expectations and are critical to reward learning. When expectations are violated, predictions are updated to maximize the potential for future rewards (Schultz, 2015). Prediction errors are reflected in neuronal activity in the mesolimbic dopaminergic system when better-than-expected and worse-than-expected rewards are received (Daniel & Pollmann, 2014; Schultz, 2015). Social prediction errors occur when expectations about social outcomes are violated, facilitating the updating of future predictions about social reward (Ruff & Fehr, 2014). It is possible that disruptions in neural mechanisms of social prediction errors contribute, in part, to social interaction deficits of individuals with ASD. Although there is growing functional neuroimaging literature addressing reward processing deficits in ASD (Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012), most studies have addressed reward anticipation or receipt, but almost none have addressed social prediction errors in ASD. It is critical to examine social prediction errors in ASD, since this neural system is critical for social learning.
Objectives: To compare blood oxygen level dependent (BOLD) signals among adolescents with and without ASD during a social prediction error task.
Methods: The sample included 41 12-to-17-year-olds: 21 with high-functioning ASD and 20 with typical development (TD). Prior to the scan, participants were taught to press a "check" every time they saw a symbol (i.e., "cue 1") that predicted a clear image and an "x" every time they saw a different symbol (i.e., "cue 2") that predicted a blurry image. In the scanner, participants saw images of smiling faces (i.e., social reward) or blurry faces (i.e., non-reward) across two 7-minute runs. In 20% of trials, the images violated expectations (i.e., "cue 1" predicted a blurry face, rather than a clear face as expected; "cue 2" predicted a clear rather than blurry face). Analyses focused on group differences with respect to the contrast between expected and unexpected reward outcomes, which are known to elicit prediction error signals in the midbrain, striatum, and prefrontal cortex (Ramnani, Elliott, Athwal, & Passingham, 2004),
Results: Data collection is complete and analysis is ongoing. Preliminary analyses found that the TD group demonstrated increased activation in the right inferior frontal gyrus compared to the ASD group when expectations were violated, whereas the ASD group demonstrated increased activation in the right frontal pole. When outcomes were as expected, the TD group demonstrated increased activation in the right frontal pole, whereas the ASD group exhibited increased activation in the left inferior frontal gyrus. Ongoing analyses will examine functional connectivity differences between groups, as well as relations between brain imaging metrics, task related behavior, and ASD symptom severity.
Conclusions: Preliminary results indicate differential activation in prefrontal cortical regions that are critical for eliciting prediction error signals in adolescents with ASD. These differences may provide a mechanistic account of disrupted social reward learning in ASD and contribute to the literature addressing reward processing deficits in ASD.

104 **125.104** Neural Theory-of-Mind Mechanisms and Their Relations to Children's Social Functioning

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Background: Theory of mind (ToM), the ability to reason about others' mental states, is a core facet of social cognition implicated in autism spectrum disorder (ASD). Neuroimaging evidence indicates that adolescents and adults with ASD show atypical activation in the neural ToM network during mental state reasoning. In addition, a recent study suggests that activation in the right temporoparietal junction (rTPJ), a key node of the ToM network, is linked to ASD symptom severity. Although influential developmental theories posit that ToM is central to social understanding and functioning, the relations between neural ToM mechanisms and the broad spectrum of empathy and social ability observed across typical (TD) and atypical child development remain unclear.
Objectives: This study aimed to (a) identify neural activation specifically elicited by ToM reasoning and to (b) elucidate relations between these neural ToM mechanisms and individual variation in children's socioemotional functioning. We predicted that TD children would demonstrate enhanced activation at key nodes of the ToM network (i.e., bilateral TPJ and precuneus) during mental state reasoning. Moreover, we hypothesized that the strength of this activation would be associated with individual variation in children's empathy and social functioning.
Methods: Participants were 32 TD children between 9 and 13 years old. Functional neuroimaging (fMRI) data were collected on a 3T scanner while participants completed a false belief task developed for children. In the experimental (ToM) condition, children listened to vignettes describing social scenarios and then evaluated characters' beliefs. In the control condition, they listened to non-social scenarios and then made inferences about physical causality. Children also completed a behavioral measure of empathy (Interpersonal Reactivity Index), and parents completed measures assessing multiple facets of their children's social abilities (Social Responsiveness Scale, 2nd edition) and competence (Child Behavior Checklist).
Results: Â Whole-brain analyses indicated enhanced activation to ToM reasoning versus the control task at key nodes of the ToM network, including the bilateral temporoparietal junction (rTPJ and lTPJ) and precuneus (p<.05, FWE-corrected). Controlling for age, greater activity in the bilateral TPJ correlated with reduced empathic concern for others (rTPJ: ρ=-0.46, p=0.01; lTPJ: ρ=-0.46, p=0.01) and poorer social competence (rTPJ: ρ=-0.56, p=0.03; lTPJ: ρ=-0.52; p=0.04). In addition, greater activity in the precuneus (ρ=0.48, p=0.02) and lTPJ (ρ=0.41, p=0.06) correlated with diminished social awareness.
Conclusions: During mental state reasoning, children engaged a distributed ToM network previously identified in adults. Moreover, greater activation in the TPJ and precuneus was associated with poorer socioemotional functioning, suggesting that reduced efficiency of ToM regions is linked to difficulties in empathy and social functioning among school-age children. These findings have important translational implications for understanding social deficits in children with ASD: dysregulation of ToM network activation may be a core neural mechanism underlying impaired social understanding and interaction. Our results also indicate that neural ToM mechanisms index individual variation in socioemotional behavior, demonstrating value as a biological metric of functional heterogeneity in social development. Ongoing connectivity analyses explore relations between functional integration of the ToM network during mental state reasoning and variation in children's social cognition and functioning.

105 **125.105** Neural and Attentional Indices of Joint Attention in ASD

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Background: Decreased joint attention is a symptom of autism spectrum disorder (ASD) commonly observed in clinical contexts. However, lab-based investigations have yielded inconsistent findings using both brain and behavioral measures. Prior research on gaze perception in ASD has focused on passive observation of social information, failing to address the interactive nature of joint attention. This research has identified atypicalities in event-related potential (ERP) and eye-tracking indices of gaze processing in individuals with ASD, but it is unclear how brain activity and attention unfold within interactive contexts.
Objectives: We developed an interactive neuroscience experiment to assess: (1) brain activity during simulated joint attention tasks in individuals with ASD; (2) visual attention and its relationship to brain activity during an interaction; and (3) the relationship of brain activity and attention to social function.
Methods: EEG was recorded from adolescents with ASD (N=33, mean age=14.15, mean IQ=112) and TD controls (N=31, mean age=14.4, mean IQ=110) using a 128 electrode net. ET was simultaneously recorded at 500hz and enabled the experiment to respond to the participants' gaze, simulating a social interaction. When participants looked at an onscreen face, it responded by returning gaze to the participant or looking to a treasure chest target in one of four corners of the screen. If the participant maintained eye contact with the onscreen face, they were rewarded with the face reciprocally smiling. If they followed gaze to the treasure chest, they were rewarded by the chest opening and showing a jewel. ERPs were time-locked to joint attention bids from the onscreen face (averted gaze or eye contact) and feedback (smiling faces, jewels).
Results: Preliminary analyses indicated that individuals with ASD displayed differential patterns of brain activity and attention during interactions. Individuals with ASD were slower to look to cued targets [t=-2.6, p=.008] and exhibited larger P100s to non-social feedback [F(41)=5.79, p=.021], suggesting differential patterns of anticipation. Temporally subsequent brain activity revealed that both groups displayed greater response to social feedback at the P200 [F(41)=8.58, p=.006] and P300 [F(41)=13.558, p=.001]. This activity was correlated with social function across groups such that reduced neural sensitivity to social reward predicted poorer social function on the Social Responsiveness Scale [r=.37, p=.033] and the Child Behavior Checklist [r=.44, p=.009]. Analyses in progress incorporate pupil dilation and oscillatory activity.
Conclusions: In an interactive social context, individuals with ASD exhibited atypical patterns of anticipation and response as measured by both brain activity and eye-tracking. Overall, both groups showed similar patterns of brain activity in response to social and non-social feedback, suggesting preserved basic mechanisms across groups. However, variability in phenotype predicted differential brain response, reflecting the importance of individual differences across groups. These findings demonstrate that interactive neuroscience approaches occupy a fruitful middle ground between passive experimental measures and unconstrained clinical contexts, and reveal meaningful relationships between clinical heterogeneity and well-specified markers of brain activity.

106 **125.106** Neural and Behavioral Responses in an Executive Functioning Task Predict Social Communication Symptoms in Children with Autism Spectrum Disorder

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Background: Underlying many of the social and cognitive symptoms exhibited in individuals on the autism spectrum is a deficit in executive functioning (Robinson, 2009). Executive functioning is defined as the ability to manage complex problems in the service of a goal. This skill involves the inhibition of conflicting information, decision-making, and shifting of attention. Impairments in these cognitive capacities are often observed in ASD, and can have direct implications for the ability to successfully navigate social situations. Little research has been done on whether specific neural components elicited during executive functioning tasks can predict the social deficits exhibited in ASD.
Objectives: To assess the correlation between inhibitory control, a core domain of executive functioning, and social communication symptoms in children on the autism spectrum, using behavioral and electrophysiological data.
Methods: 72 children with ASD were recruited from the University of Washington and Boston Children's Hospital for participation in this study. Children ranged from 7 to 11 years old (64 males; 8 females) with a minimum IQ of 80 measured using the WASI-2 (Wechsler, 2011), and diagnosis was confirmed through DSM-V criteria (American Psychiatric Association, 2013) after administration of the ADOS-2 (Gotham, Risi, Pickles, & Lord, 2007) and the ADI-R (Rutter, Le Couteur, & Lord, 2003). Parents completed the Social Responsiveness Scale (SRS), the Social Skills Improvement System (SSIS), and a Vineland-II interview on behalf of their child. To measure inhibitory control, both percent accuracy and reaction times were recorded during a flanker task called the Attentional Network Task (ANT). Electrophysiological recordings were also collected during this task to examine the N2 and P3 ERP components. Difference scores for both ERP amplitude and latency were computed for each of these components by taking ERP cluster averages for congruent trials, and subtracting from the incongruent trial average. Larger difference scores suggest more effortful processing for the more difficult incongruent trials of this task.
Results: Linear regression analyses were performed controlling for age, IQ, and gender. Severity scores on the ADOS Social Affect subdomain were predicted by percentage of correct incongruent trials (R^2_{change} =.0552, t(72)=-2.094, p=.040), and reaction time for correct congruent trials (R^2_{change}=.049, t(72)=2.029, p=.046), such that more severe social symptoms correlated with poorer performance. Percentage of incongruent trials also predicted scores on the SRS (R^2_{change} =.191, t(65)=-3.846, p=.000), The amplitude of the N2 component predicted scores on the Social Engagement domain of the SSIS (R^2_{change}=.106, t(54)=2.501; p=.016).
Conclusions: The severity of social symptoms in our population of children with ASD was predicted by both behavioral performance and specific ERP components in an executive functioning task measuring inhibition. Poorer performance and slower reaction times in this task, as well as larger differences for N2 amplitudes between congruent and incongruent trials, was associated with greater deficits in social communication. The ability to inhibit conflicting or interfering information is an aspect of executive functioning vital to communicating and interacting with others in one's environment, and our findings suggest a neurological source for these social deficits in children with ASD.

107 **125.107** Observation of Goal-Directed Social Actions in Individuals with Autism Spectrum Disorders

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Background:
The mirror neuron system (MNS), which becomes active during both action execution and action observation, is assumed to be involved in processing social information. Social communicative symptoms related to autism spectrum disorders (ASD) have been proposed to result from impairments in the MNS, however mixed results were found by previous studies.
Objectives:
To the best of our knowledge, this is the first study to compare modulations of MNS activity by the social relevance of observed actions in typically-developed young adults and in young adults with ASD.
Methods:
Participants
In the present study 20 individuals with an official diagnosis of ASD (M = 19.8 years) and 25 typically-developed (TD) individuals (M = 21.8 years) were included. ASD diagnoses were confirmed by administrating the ADOS-2 module 4.
Stimuli and procedure
Electroencephalography (EEG) recordings were obtained during the observation of video clips depicting two actors playing a simple card game governed by a set of rules, which were explained to the participants prior to the experiment. Four conditions that differed in social relevance were presented: dyadic, social, individual, and no action (baseline). Mu suppression, power reduction in the 8-13 Hz frequency band at the sensorimotor areas, was taken as index for MNS activity.
Results:
The TD group demonstrated significant mu suppression during the observation of the three types of actions and not during the observation of a still image. The degree of mu suppression was similar for the different action conditions, though increased mu suppression was found in the dyadic action condition compared to the social action condition. In contrast to the TD group, the ASD group did not show significant mu suppression during the observation of the three different actions. Due to the absence of mu suppression in all action conditions, no modulation by social relevance was detected.
Conclusions:
Based on the current findings it can be concluded that individuals with ASD might have a dysfunctional MNS, which contributes to our understanding of neurological impairments related to ASD. The indication that the MNS is not activated during the observation of both simple individual actions and more complex dyadic actions, suggests a global, rather than a specific, deficit of the MNS in individuals with ASD. The proposed link between ASD and a dysfunctional MNS could lead to new approaches for diagnosing and treating ASD. For example, therapy using imitation techniques could be an effective form of treatment in infants and children with ASD to stimulate the MNS at an early age.

108 **125.108** Reduced Neural Activity in the Action Observation and Mentalizing Network in Children and Adolescents with Autism Spectrum Disorder during Execution, Imitation and Mentalization of Social and Motor Actions

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Background: A growing body of literature suggests that children with ASD often have motor deficits and that these deficits may be related to social skills in ASD (Dziuk, 2007). Previous imaging work has shown that motor system networks (e.g., Action Observation Network (AON)) play a role in supporting intention understanding as well as imitation (Iacoboni, 2005). It is thus possible that mechanisms underlying motor impairments contribute to social deficits in ASD. To our knowledge, no study to date has investigated social and motor neural processing in ASD across a spectrum of social-motor stimuli.
Objectives: (1) To assess neural differences in children with and without ASD while they observe, execute, imitate and mentalize social and motor actions. (2) To assess how these differences may be related to group differences in social and motor skills assessed with the Social Responsiveness Scale (SRS; Constantino, 2003) and the Sensory Integration and Praxis Test (SIPT; Ayres, 1988).
Methods: Six high-functioning children and adolescents with ASD (mean age [years] 11.26±1.09) and ten typically developing (TD) participants (mean age [years] 11.25±1.41) were recruited. Imaging data was collected on a 3-T Siemens MAGNETOM Prisma scanner. The imaging protocol included a T1-weighted structural and standard EPI scans. In the scanner, participants observed, executed, imitated and mentalized separately to three video stimuli conditions: (1) emotional expressions (i.e., Happy), (2) Non-Emotional expressions (i.e., wiggle nose) and (3) hand actions (i.e., cutting paper). Using a block design, each condition was randomly presented for 15-seconds followed by 15-seconds of rest. Standard preprocessing and motion scrubbing were performed. Direct comparisons between groups were made in regions of the AON (i.e., Inferior frontal gyrus; IFG). The degree of social and motor skills was analyzed to determine group differences in ability.
Results: TD and ASD groups showed no group differences in AON activation when observing social and motor actions. However, during the motor action tasks, the ASD group showed reduced activity in IFG compared to the TD group (bilateral during execution and left lateralized during imitation (p<.054)). During mentalizing, ASD participants showed decreased recruitment of action understanding regions; the left IFG (p<.039) and temporal parietal junction (TPJ; p<.078) when processing the most novel stimuli (non-emotional faces) and the most social stimuli (emotional faces), respectively. Groups differed behaviorally in motor (p<.002) and social skills (p<.001).
Conclusions: Our results support previous findings of behavioral and neural motor processing deficits in ASD. Specifically, these data suggest an impairment in the AON which may be related to sensory-motor mapping in the IFG. Differences observed in the hand conditions may be driven by the execution of hand actions since group differences were not seen during observation of the actions alone. Our mentalizing findings concord with the theory that left IFG activation during mentalizing may underlie communication disorders in ASD (Kleinhas, 2008) and TPJ activation with more social processing deficits. Ongoing analysis will continue to investigate these findings and make direct comparisons of brain function and behavioral characteristics associated with the AON.

109 **125.109** Representational Similarity Between Non-Symbolic and Symbolic Numerical Stimuli in High Level Visual Areas Is Uniquely Related to Individual Differences in Arithmetic Skills in Children with Autism

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Background: Recent findings have shown that while solving arithmetic problems, children with Autism Spectrum Disorders (ASD) display a unique pattern of brain organization that differs significantly from their Typically Developing (TD) peers (Iuculano et al., 2014). However, proficient arithmetic skills develop from more fundamental abilities. These include representing and manipulating different types of numerical information, such as arrays of dots (i.e., non-symbolic format) or pairs of Arabic digits (i.e., symbolic format) (Butterworth, 2003). Currently, nothing is known about how children with ASD process these basic numerical stimuli. Crucially, successful mapping between non-symbolic and symbolic stimuli has been proposed to be a strong predictor of arithmetic skills during typical development (Hiniker et al., 2015; Ansari, 2008).
Objectives: Here we investigate whether (i) children with ASD exhibit a unique pattern of neural mapping between non-symbolic and symbolic stimuli, compared to TD children; (ii) a higher degree of representational similarity between these two stimulus-types is related to individual differences in arithmetic skills in children with ASD.
Methods: Â We assessed a group of children with ASD (N =25; M_{age} = 10.55, SD = 1.36; 23 males; IQ = 109.96) and a matched group of TD children (N = 25; M_{age} = 10.07, SD= 1.35; 21 males; IQ = 112.12). ASD diagnosis was determined using the Autism Diagnostic Interview- Revised (ADI-R) and/or the Autism Diagnostic Observation Schedule (ADOS). A subtest of the Woodcock-Johnson III Tests of Achievement (Woodcock et al., 2001) battery was used to assess math proficiency in each participant. All children participated in a functional Magnetic Resonance Imaging (fMRI) session where they were asked to select the larger of two quantities, which were presented either in a non-symbolic or symbolic format. We used Representational Similarity Analysis (RSA; Kriegeskorte et al., 2008) to examine the degree of similarity between multivariate patterns of activity for non-symbolic and symbolic stimuli in both groups.
Results: At the behavioral level, performance did not differ between ASD and TD children during the non-symbolic or symbolic comparison tasks. At the neural level, children with ASD showed greater RS values between non-symbolic and symbolic stimuli than TD children in multiple brain regions that support successful numerical manipulations (Ansari, 2008). These included the dorsal and ventrolateral prefrontal cortices, the intraparietal sulcus, and the fusiform gyrus. TD children did not display any regions of greater RS values, compared to children with ASD. Importantly, higher representational similarity between non-symbolic and symbolic stimuli in the right fusiform gyrus significantly predicted better arithmetic skills in ASD (r = 0.48, p = 0.02). This was not evident in TD children.
Conclusions: These results suggest that children with ASD display a unique neural mapping between non-symbolic and symbolic stimuli, compared to TD peers. Critically, these findings support the idea that high level visual processing areas, particularly the fusiform gyrus, play a crucial role in the successful development of arithmetic skills in ASD.

110 **125.110** Resting Gamma Power Predicts Language Ability in Infants at Risk for ASD

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Background: High frequency electrophysiological oscillations (gamma band: 30-50 Hz) are involved in binding local neural circuitry during language and cognitive processing (Basar 2013). During typical development, spontaneous gamma oscillations increase between 3-4 years of age and peak at 4-5 years (Takano 1998). While higher gamma power during toddlerhood has been shown to predict greater language and cognitive abilities (Gou 2011), the development and significance of gamma power in the first year of life, in the context of typical development and autism risk, is unknown. Infants are at high risk (HR) of developing ASD if they have an older sibling with ASD. Given the high rates of language difficulties in HR infants (Messinger 2013), early predictors of language development are important to establish.
Objectives: To examine whether baseline EEG power in the gamma frequency band measured at 6 months of age predicts language abilities at 12 and 18 months in infants who are at high risk (HR) and low risk (LR) of developing ASD. We hypothesized that higher gamma power will correlate positively with later language abilities, with a stronger positive correlation in LR infants compared to HR infants.
Methods: Â The sample included 28 HR infants and 17 LR infants. EEG was recorded at 6 months and behavioral testing was conducted at 12 and 18 months (m12, m18) using the Mullen Scales of Early Learning (Mullen) and MacArthur-Bates Communicative Development Inventory (MCDI). Baseline EEG was recorded using a high-density system for 2 minutes while infants watched a video of bouncing soap bubbles. EEG data were processed using Net Station 4.4.5 software (McEvoy 2015), and independent component analysis was done using EEGlab. Relative spectral power for gamma frequency band was calculated using Welch's method and averaged across 3 frontal regions.
Results: Â HR and LR infants did not differ in frontal gamma power. LR infants trended towards having higher language scores than HR infants, but the difference was not significant (Table 1). When HR and LR groups were combined together as one cohort, frontal gamma power did not correlate with language scores. Within the HR group, frontal gamma power positively correlated with m12 Mullen verbal developmental quotient (DQ), m18 Mullen verbal DQ, m18 Mullen receptive and expressive language, and m18 MCDI words understood. In the LR group, frontal gamma power did not correlate with language scores (Table 2).
Conclusions: Findings in the HR group support our hypothesis that higher gamma power positively relates to later language abilities. Our study is the first to examine the relationship between baseline gamma power and language ability in early infancy. In our HR infants, we replicated the positive correlation between baseline frontal gamma power and language ability as was shown previously by Gou *et al* in typically developing toddlers. Lack of differences in frontal gamma power between HR and LR groups suggest that at 6 months of age, differences in high frequency cortical activity between these two groups have not emerged. Lack of significant findings in the LR group may be due to inadequate statistical power due to sample size.

111 **125.111** Social Reward and Alpha Asymmetry in ASD

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Background: The social motivation hypothesis posits that individuals with autism spectrum disorder (ASD) are less motivated to socially engage because they find interactions less rewarding than their typically developing (TD) peers. Our previous work corroborated this by measuring neural activity during reward anticipation (Stavropoulos & Carver, 2013; 2014). Our studies focused on event-related potentials (ERPs), which provided information about the timing of neural activity. Electrophysiology data also provides information about oscillatory patterns. Of particular relevance is activity in the alpha band (8-12Hz). Reduction in alpha is thought to reflect increased engagement, and left-hemisphere dominant alpha asymmetry (more left activation than right) is hypothesized to reflect approach motivation and reward.

Objectives: The current investigation measured alpha asymmetry during reward anticipation. We performed novel EEG analyses on brain activity in children with and without ASD (Stavropoulos & Carver, 2013). In this study, children were presented with reward indicators accompanied by face or non-face stimuli. Non-face stimuli were comprised of scrambled faces in the shape of arrows.

Methods: Participants were 6-8 year-old children with (n = 20) and without (n = 20) ASD. EEG data in the alpha band (8-12Hz) was extracted using EEGlab. Data were analyzed from four sets of left/right hemisphere (L/RH) electrodes in frontal, central, parietal, and temporal locations. To measure alpha asymmetry, log values from LH electrodes were subtracted from comparable RH electrodes for each location (frontal, central, parietal, temporal). ANOVAs were conducted on each location separately with Condition as a within-subjects variable, and Group as a between-subjects variable.
Results: A significant Condition x Group interaction was observed for temporal electrode locations (p = .053). Follow-up tests revealed (1) marginal effects of condition in the ASD group (p = .058); ASD children demonstrated greater LH activation for the arrow versus face condition, and (2) a marginally significant effect of the face condition between groups (p = .066); TD children evidenced greater LH activation when anticipating faces compared to children with ASD. Finally, we explored correlations between severity of ASD symptoms and alpha asymmetry in temporal electrodes. A significant correlation was observed between alpha asymmetry in the arrow condition and ADOS severity score (p= .01), Figure 1. Children who evidenced greater LH activation for the arrow condition had more severe symptoms of ASD.
Conclusions: We provide novel evidence that alpha activity during reward anticipation is different in children with and without ASD. Children with ASD evidenced more left-dominant activation when anticipating rewards accompanied by arrows compared to rewards accompanied by faces. Given that actual rewards were the same in both conditions, we suggest that children with ASD experience more approach-motivation prior to non-social versus social stimuli. Interestingly, this difference is correlated with symptom severity. Finally, TD children evidenced more left-dominant activation when anticipating social stimuli compared to children with ASD. Taken together, the findings support the social motivation hypothesis, and extend it by suggesting that children with ASD may have *too much* non-social motivation, which comes at the expense of social motivation.

112 **125.112** Spontaneous Alpha Oscillations Stratify Children Across the Autism Spectrum Based on Cognitive Ability

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Background:
Electroencephalography (EEG) measures of spontaneous brain oscillations hold particular promise for improving our understanding of the neurobiological bases of the clinical heterogeneity observed in autism spectrum disorders (ASD). Of particular relevance within the EEG signal are spontaneous alpha oscillations. The typical increase in peak alpha frequency seen during childhood is said to reflect the development of thalamo-cortical connections (Valdés-Hernández et al., 2010); disruptions to which are said to also manifest through atypical levels of alpha power (Doesburg et al., 2011). Therefore, measures of peak alpha frequency and alpha power may provide a sensitive marker of altered trajectories of neurodevelopment in ASD at an early age.
Previous studies have reported atypical alpha power (Wang et al., 2013) and peak frequency development in ASD (Edgar et al., 2015). However, there are no reports of spontaneous alpha oscillations in an ASD sample with variable cognitive abilities. It is currently unknown whether spontaneous alpha oscillations are altered consistently across a representative sample of children with ASD or whether they distinguish subgroups based on cognitive ability.
Objectives: We asked whether the power and frequency of spontaneous alpha oscillations distinguished children with ASD from age matched typical children and, moreover, whether alpha power and frequency differentiated children with ASD who had comorbid intellectual disability (ID).
Methods: Fifty-seven children with an ASD diagnosis (mean age=5.6 years, range= 2-12 years) were split into 'Low-IQ' (IQ = 11-69; N=30) and 'High-IQ' (IQ= 70-126; N=27) groups based on an IQ cut-off of 70. Forty age-matched typically developing (TD) children (IQ = 95-148) served as a control group. High-density EEG was recorded under task-free conditions while children watched bubbles on a computer screen. Relative alpha (8-12Hz) power and peak frequency were calculated.
Results: TD children showed the expected increase in peak alpha frequency with age (r=>.5, p=<.001), as did children in the high-IQ ASD group (r=0.35, p=0.05). However, this relationship was absent in the low-IQ ASD group (p=>.5). Low-IQ ASD participants showed lower alpha (p=<.01) power across the scalp and lower frontal peak alpha frequency (p=.02) compared to controls. Alpha power (p=>.52) and peak frequency (p=>.30) across the scalp did not differ between high-IQ ASD participants and controls.
Conclusions:
Our results suggest that while the typical development of peak alpha frequency with age is disrupted in ASD, this disruption seems to be driven by co-occurring ID. We also find reduced alpha band power differentiates children with comorbid ID and ASD. Together, these findings suggest that electrophysiological markers of atypical neural function may not be consistent across the spectrum in ASD. Whether these oscillations represent a biomarker of ID rather than ASD will require investigation in children with ID without ASD.
Furthermore, in the context of previous literature, the present study indicates that the level of disruption to the development of thalamo-cortical connections may contribute to the variability in EEG power measures previously reported in ASD. Our future research will utilize longitudinal data to determine how changes in peak alpha frequency are associated with the development of cognitive abilities across the autism spectrum.

113 **125.113** Structural and Functional Characteristics of XYY - Relationship to ASD

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Background:
47,XYY syndrome (XYY) is a male sex chromosome disorder (two instead of one Y chromosome) associated with significantly increased risk (ranging from 19-50% in pre- and post-natally diagnosed cohorts) of autism spectrum disorder (ASD) diagnosis. While XYY occurs in ~0.1% of males in the general population it is reported in approximately 1% of males with ASD. This increased level of risk coupled with the 4:1 male preponderance in idiopathic ASD (ASD-I) and the recent interest in Y chromosome genes (i.e. NLGN4Y) makes XYY a potentially compelling genetic model of ASD.
Objectives: The focus of this study is to investigate, and potentially disambiguate, the effects of genotype (XYY vs. XY) and clinical phenotype (ASD vs. non-ASD) on neuroimaging measures of structure and function. ASD related neuroimaging measures were contrasted between four groups of boys (6-17 years old), ASD-I, typically developing (TD) and XYY boys meeting (XYY+ASD) and not meeting (XYY-ASD) diagnostic criteria for ASD.
Methods: Neuroimaging data was acquired from 10 XYY+ASD boys (12.8±4.1 years), 7 XYY-ASD (12.4±3.9 years), 16 TD (11.0±3.1 years) and 19 ASD-I (10.2±1.4 years) boys. The neuroimaging protocol consisted of a 3T structural MRI (1mm isotropic resolution), diffusion MRI (b1000s/mm^2 DTI) and whole cortex magnetoencephalography (MEG) recordings acquired during a passive auditory paradigm (500Hz sinusoidal tones). Statistical methods included an age-covaried 4x1 ANOVA to investigate Group differences and 2x2 age-covaried LMMs to investigate main effects of XYY and/or ASD status. Hemisphere was considered as an additional factor in omnibus LMMs; subsequently hemispheres were interrogated separately.
Results: There were no significant differences between groups, nor main effects of XYY or ASD status on structural MRI measures such as total grey matter volume. Fractional anisotropy values, derived from the white matter of Heschl's gyrus (as a surrogate for the thalamocortical auditory radiations) showed a strong tendency towards left hemisphere-only reduction of FA as a main effect of XYY status (XYY: FA=0.30+/-0.02; XY: FA=0.35+/-0.01, p=0.08). Commensurately, in the left hemisphere only, evoked responses from auditory cortex showed significantly delayed M100 latency values as a main effect of XYY status (XYY: M100=162+/-8ms; XY: M100=128+/-5ms, p<0.01). Effect of genotype (XYY status) dominated effects of clinical diagnosis (ASD status), but there was a tendency towards an additive interaction (M100 latency was most prolonged in the XYY+ASD group, although the interaction did not reach significance).
Conclusions: The XYY genotype appears to be associated with atypical maturation of auditory pathway white matter, with consequent significant delays in auditory cortex evoked responses. While these phenomena have previously been associated with idiopathic ASD cohorts, our observations implicates genotype as the dominant basis for these structural and functional sequelae.

114 **125.114** Superior Temporal Sulcus Response in Attributing Social Meaning to Actions in Autism Spectrum Disorder

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Background: Previous studies have shown that individuals with Autism Spectrum Disorder (ASD) often struggle to accurately attribute emotions and intentions to others. Such failures in ASD may result from a limited ability to attribute biological agency. In other words, a reduction in anthropomorphism - the attribution of human characteristics, intentions, or behaviors to non-human animals or objects (Chaminade et al., 2007). Due to its widespread and implicit nature, anthropomorphism is generally considered an innate human tendency (Hutson, 2012). However, children with ASD are less likely than their peers to use anthropomorphic language (Hieder & Simmel, 1944). Furthermore, neuroimaging studies have shown reduced activation in certain mentalizing regions (superior temporal sulcus, STS; medial prefrontal cortex, MPFC; and anterior cingulate cortex, ACC) during social attribution in ASD (Kana et al., 2009) and in response to biological motion (Pelphrey et al., 2005). Relatively less work has looked at the neural correlates of anthropomorphism combining social attribution and biological motion processing in ASD.
Objectives: Â To examine the neural correlates of attributing social meanings to human and non-human figures in dynamic anthropomorphic scenarios in ASD.
Methods: Â 34 age-and-IQ-matched participants (17 ASD, 17 TD) viewed short animations of either human-like stick figures or geometrical shapes (such as triangles) engaged in a series of random or socially meaningful movements (i.e. bullying, helping) during functional MRI scanning. In an event related design, participants were asked to determine via button press whether the character's movement was social or random. Structural and functional images were acquired in a 3T Siemens Allegra head-only scanner (17 oblique-axial slices; TR=1,000ms; TE=30ms) and processed in SPM12.
Results: Â ASD and TD groups were equally accurate at identifying social movement by human and non-human characters [Diagnosis x Movement x Character: F(1,28)=.103,NS]. Within-group analysis of functional activation revealed that observation of socially meaningful movement, regardless of character, activated bilateral posterior STS, bilateral MPFC, and the precuneus (Monte Carlo simulation corrected, p=.005, k=100) in the TD group. Activation in the ASD group was limited to the right pSTS and left MPFC. Furthermore, in the TD group attributing social vs non-social motives to shapes (anthropomorphism) was associated with greater activation of the left pSTS and bilateral MPFC compared to no activation differences in the ASD group. Direct comparison of brain activation between ASD and TD groups revealed a significant decrease in left pSTS activation in the ASD group associated with anthropomorphism (MC corrected, p=.01, k=200).
Conclusions: This study demonstrated that despite equal accuracy at identifying social movement of non-social objects, high functioning individuals with ASD may be using slightly different neural resources to accomplish the task compared to their TD peers. The findings of this study underscore the role of pSTS in biological and social information processing as it was recruited for human and non-human social movements alike. Greater bilateral recruitment of pSTS by the TD group when observing the social movement of shapes may reflect a stronger neural response toward anthropomorphism, whereas underactivity of this region in ASD may be a neural signature of their altered social functioning.

115 **125.115** The Development of Neural Correlates Associated with Visuo-Spatial Working Memory in Children with ASD: 2-Year Longitudinal fMRI Study

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Background: Prior research has shown persistent impairments in visuo-spatial working memory (WM) in individuals with Autism Spectrum Disorder (ASD), compared to normative populations. Existing neuroimaging studies suggest reduced brain activation in fronto-parietal regions during WM tasks in both children and adults with ASD. However, our understanding of the neurodevelopmental patterns accompanying WM is limited. It is suggested that social deficits related to ASD could be explained in part by degraded memory ability. Social and environmental demands become increasingly complex as children mature to adolescents, and thus it is important to consider the development of associated underlying neuropsychological systems, such as WM processing, that are vulnerable in ASD.
Objectives: The purpose of the current study was to examine functional changes longitudinally, over 2 years, in neural correlates of WM in children and adolescents with and without ASD, and the impact of increasing cognitive load.
Methods: Measures of brain activity were acquired with functional magnetic resonance imaging (fMRI) during a visuo-spatial 1-back WM task with four levels of difficulty. A total of 14 children with ASD and 15 age- and sex-matched typically developing children (ages 7-13) were included at baseline and followed up approximately 2 years later. Diagnosis of ASD was confirmed using the Autism Diagnostic Observation Schedule (ADOS). Neural changes between the hardest and easiest difficulty level were analyzed, and the longitudinal change of this contrast was compared between children with and without ASD using a Group x Time interaction.
Results: Although similar task performance was seen at baseline and follow-up across groups, differences were evident in the developmental trajectories of neural responses. Typically developing children showed greater load-dependent activation which increased with age in frontal, parietal and occipital lobes and the right fusiform gyrus, compared to those with ASD. In these areas, children with ASD showed little load dependent increases. However, the ASD group showed greater longitudinal load-dependent *decreased* activation in default-mode related areas (parahippocampal gyrus and ventro-medial prefrontal cortex) compared to controls.
Conclusions: Our results suggest a lack of neural modulation with increasing cognitive demand in parietal-occipital cortical areas in children with ASD that showed no significant maturation into adolescence, in contrast to typically developing peers. Further, children with ASD demonstrated delayed, rather than arrested, maturation of DMN-related areas as observed by increased load-dependent suppression of brain activity across time, relative to typical children. Children with ASD may become quickly saturated and overwhelmed with incoming information, impacting their ability to balance multiple demands of their environment, which becomes increasingly more complex in adolescence. Thus, the period from childhood to adolescence is a critical time to support children with ASD by teaching them skills for facilitating WM (e.g., chunking strategies) and providing them with appropriate accommodations to compensate for WM deficits; this will allow them to benefit more from academic, social and/or behavioural interventions.

116 **125.116** The Impact of Stimulant Medication on EEG Alpha Power in Children with Autism Spectrum Disorder

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Background: It has been estimated that 56% of children with autism spectrum disorder are taking at least one psychotropic medication (Mandell et al., 2008). These rates of medication use present a challenge for researchers studying brain activity in autism using EEG. For example, stimulants are one of the most commonly prescribed medications in autism, with approximately 22% of children taking some type of stimulant (Mandell et al., 2008). If children on medication are included in a study it may be impossible to differentiate brain responses due to medication from brain responses related to autism. However, if researchers choose to exclude individuals taking medications from their study, they could be eliminating a significant portion of children with autism, resulting in a limited and/or biased sample.
Objectives: This study will leverage the large sample size of the ACE GENDAAR Project to investigate the potential impact of psychotropic medication on EEG alpha power. To parse out the different effects of medications and the behaviors they're prescribed to treat, we will examine EEG alpha power and stimulant use in children with and without externalizing behaviors.
Methods: Â High density EEG was collected while children with autism between the ages of 8 and 17 completed a resting task that alternated passively viewing screensaver-like videos (Eyes Open condition) and sitting with eyes closed (Eyes Closed condition). Movement and blink artifacts were rejected, and FFT was performed over clean segments. Average power across 8 – 12 hz for mid-posterior electrodes was calculated for each subject. High externalizing behaviors were characterized as a Child Behavioral Check List domain of Externalizing Problems score in the borderline or clinical range (T score > 59). Of children with autism 22 were reported as taking a stimulant (High Externalizing, n = 10; Low Externalizing, n = 12) and 79 were not on a stimulant (High Externalizing, n = 28; Low Externalizing, n = 51); the samples did not differ on age (p = .35) or IQ (p = .53).
Two-way ANOVAs were calculated to look at the effects of both Externalizing (high, low) and Stimulant Medication (Stimulant, No Stimulant) on mid-posterior alpha power for both Eyes Open and Eyes Closed conditions.
Results: In the Eyes Open condition, there was a significant main effect of stimulant, $F(1,98) = 4.55$, $p = .04$; and on the Eyes Closed condition, there was a marginal main effect of stimulant, $F(1, 95) = 2.95$, $p = .089$). This suggests that regardless of externalizing levels, children who are currently taking stimulant medication have significantly higher mid-posterior alpha power compared to children who are not on stimulant medication.
Conclusions: These findings indicate increased mid-posterior alpha power in children with autism who are taking a stimulant medication, and provide evidence for the importance of taking medication status into account during EEG analyses. Findings will be extended by looking at alpha power spectra in other regions, including frontal alpha and hemispheric differences in alpha power.

117 **125.117** The "Speech-to-Song Illusion" in Children with Autism Spectrum Disorder

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Background: Children with Autism Spectrum Disorder (ASD) have been shown to demonstrate differences in behavioural and neural processing of speech, but they also show intact music and song processing (Lai et al., 2012). However, the degree to which music and speech share neural resources is currently unclear, limiting the use of music for neuro-rehabilitation. The "speech-to-song illusion" (Deutsch et al., 2011), in which acoustically identical stimuli may be perceived as speech or song through repetition of a spoken phrase, offers a novel approach to investigate the overlap between speech and music. This work can guide auditory-based interventions in ASD.
Objectives: The aims of the current study were to investigate 1) whether children with ASD and typically developing (TD) children perceive the "speech-to-song illusion" similar to TD adults, and 2) the neural correlates of this illusion in both ASD and TD.
Methods: Â Participants were 20 children with ASD aged 7-13 years and 21 TD children that were matched on age- and nonverbal IQ. ASD participants were diagnosed using the ADOS. All participants were tested on a speech-to-song illusion task that was previously validated in TD adults (Tierney et al., 2011). Stimuli were 40 spoken phrases, 20 that sounded like song when removed from context and repeated (Song), and 20 that did not (Speech). Additionally, 20 Scrambled phrases were used as an acoustic control. Participants performed a passive-listening task in a 3T MRI scanner. Stimuli were presented in eighty blocks of 16s each, where one phrase was repeated with a 0.5s interval. Speech, Song, Scrambled and Silence blocks were presented in random order. 480 whole-brain functional volumes (TR=2.57s) and a high-resolution anatomical T1, were acquired for all participants and analysed using SPM8. Following the scan, participants completed a behavioural task where they rated the same stimuli used in the functional task on a "songness" scale of 1 (Speech-like) to 5 (Song-like).
Results: A repeated measures ANOVA (Figure 1) showed a significant main effect of condition ($F_{(1,39)}=0.507$, $p<.001$). Post-hoc comparisons showed that both ASD and TD participants rated the Song stimuli as more song-like compared to the Speech stimuli ($p<.001$, Bonferroni-corrected). Both groups also rated the Scrambled stimuli as more song-like ($p<.001$). There was no main effect of group or group X condition. Preliminary analyses in TD revealed a left MFG activation for the Song-Scrambled contrast. Conversely, ASD activated the right MFG for the Speech-Scrambled contrast ($p<.05$, FWE-corrected, Figure 2).
Conclusions: These results show that both ASD and TD children perceive the "speech-to-song illusion", similar to TD adults. Interestingly, the neural correlates underlying the perception of stimuli as song or speech are distinct in both groups. Further investigation of brain activity underlying these stimuli as a function of perceptual ratings will provide insight into individual differences in speech and song processing in ASD. The behavioural validity of this task offers a novel, powerful tool to investigate the neural overlap between speech and music. This may provide a basis for the use of music-based therapies to improve speech and language in individuals with ASD.

118 **125.118** Using Complex Dynamic Video to Examine Neural Processing in ASD: A Semi-Naturalistic fMRI Study

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Background: Traditional neuroimaging paradigms often do not fully reflect the richness and complexity of the natural world in which perceptual and cognitive processes are deployed. Recent interest in improving the ecological validity of neuroimaging research has prompted the creation of alternative naturalistic paradigms and stimuli. The use of multimodal, free-flowing stimuli with varying content can allow researchers to probe multiple constructs of interest, and interactions among them, concurrently. Naturalistic or semi-naturalistic approaches can prove especially beneficial to research on autism spectrum disorder (ASD), as these approaches most closely approximate the conditions under which impairments associated with the disorder manifest.
Objectives: To explore the use of unconstrained dynamic video stimuli within a free-viewing fMRI paradigm to examine neural responses to multiple perceptual and cognitive processes concurrently, and to extend this approach to the study of ASD.
Methods: 53 participants (24 individuals with ASD and 29 neurotypical individuals) passively viewed videos (each lasting approximately fifteen minutes) over four runs while lying in an fMRI scanner. The videos were composed of movie trailers spanning multiple genres. Using ELAN and MATLAB, we defined several events of interest, including instances of humans or human faces appearing onscreen, human speech, social interaction between two or more people, low-level changes in luminance, and inter-trailer intervals during which a stimulus was not presented. We conducted separate regression analyses using FSL with each such event type as a regressor in the model. Our primary analyses assessed both the neural specificity for each event type and the reliability of the response estimates obtained for each event type across the four functional runs. We also conducted group-level analyses for each of the event types, thereby quantifying similarities and differences between neurotypical individuals and individuals with ASD.
Results: Each event type produced a largely distinct pattern of activity in the canonical neural networks that have been identified in previous research using more conventional paradigms. Activation patterns showed a high degree of reliability across the four functional runs, suggesting that individuals reliably engaged in event-level processing that was independent of the idiosyncratic aspects of the videos. Finally, while we observed some small differences in the responses from participants with and without ASD, the groups displayed remarkable similarity overall across the different event types.
Conclusions: Our findings support the feasibility and efficiency of using complex, dynamic stimuli in neuroimaging studies of ASD. The video stimuli elicited robust activation in the brain regions purported to process the classes of events examined. Additionally, our approach allowed for simultaneous exploration of a number of event types and associated neural networks within a single experiment. The similar response profiles among participants with and without ASD suggest that the ability to spontaneously process specific inputs is largely preserved in ASD and that more pronounced differences might be revealed in paradigms with a social interaction component.

119 **125.119** Variance in Language Abilities in Autism As a Function of Hemispheric Lateralization and Functional Connectivity

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Background: Â In autism spectrum disorders (ASD), the brain's language network (including Broca's and Wernicke's areas) has been found to be more right lateralized than in typically developing (TD) individuals, yet the consequences of this remain unclear. While some studies have correlated greater right hemisphere (RH) language lateralization with decreased language abilities, others argue that increased RH activity is an alternate but not inferior means of language processing. Previous literature shows that a weak hemispheric dominance in TD individuals predicts greater functional connectivity between LH and RH language areas (Tzourio-Mazoyer et al., 2015); this is important considering the disruptions in connectivity reported in individuals with ASD.
Objectives: Â To determine whether functional lateralization of Broca's and Wernicke's areas and functional connectivity between these RH and LH homologues during language processing accounts for variance in the language abilities of individuals with and without ASD.
Methods: Â High-functioning ASD (*N*=15) and TD (*N*=17) adults silently read literal and figurative sentences in a Siemens 3.0 Tesla fMRI scanner. Groups were matched on age (ASD=21.21 years, TD=21.87 years) and performance IQ (ASD=106.60, TD=107.94); however, verbal IQ (VIQ) differed significantly between groups (ASD= 102.33, TD= 114.65, $p<.05$). Based on neural activity during sentence processing, individual region-of-interest (ROI) lateralization indices (LI) and ROI-to-ROI functional connectivity were calculated in SPM12 and the LI and CONN toolboxes. Anatomical ROIs were defined using Brodmann areas BA 44 and 45 (Broca's area) and BA 22 (Wernicke's area). LI values and beta-weights of connectivity between RH and LH language homologues were treated as independent variables in two separate 3-way ANOVAs (group x LI x connectivity; one ANOVA for BA 44/45, one for BA 22) predicting variance in individual VIQ scores.
Results: Â 1) In BA 22, the three-way ANOVA yielded a significant group x LI x connectivity interaction, $F(1,24)= 7.407$, $p<.05$; 2). In BA 44/45 the same effect was not significant, $F(7,24)= 2.084$, $p= .085$. However, a two-way ANOVA testing group x LI significantly predicted VIQ, $F(3,28)= 4.319$, $p<.05$, such that in the TD group greater left lateralized activity predicted higher VIQ, while the opposite pattern was found in ASD. 3) An additional two-way ANOVA (group x BA 44/45 LI) significantly predicted interhemispheric BA44/45 connectivity $F(3,28)= 3.658$, $p<.05$, such that in the TD group connectivity increased as one's language network became less left lateralized, while no such relationship was found in the ASD group.
Conclusions: Â In BA 22, group x LI x connectivity interaction indicates that the VIQ varied extensively in the ASD group as a function of connectivity and lateralization. Most notably, in ASD a combination of weak inter-hemispheric connectivity and reduced LH dominance predicted some of the lowest VIQ's observed. In BA 44/45, the ASD group failed to show an increase in inter-hemispheric connectivity with weaker hemispheric lateralization. Overall, our findings suggest that the wide variance in VIQ seen in ASD is significantly related to interactions of functional lateralization and connectivity in this population in a manner that is distinct from what is seen in TD individuals.

120 **125.120** Word Processing of Child-Directed Speech in Young Preverbal Children with ASD

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Background: Previous investigations have shown that word processing, the cognitive retrieval of previously acquired words from mental storage, can be measured using event-related potentials (ERPs) and could be a useful predictor of language outcomes in young children with autism spectrum disorders (ASD). Other investigations have suggested that, in children with ASD, neural processing of linguistic stimuli may be aided by their tendency to attend to social stimuli, such as child-directed speech (CDS; also known as motherese).
Objectives: The current project examined processing of CDS word stimuli in young children with ASD in order to determine (a) whether they exhibited a typical neural response (at the location and time window documented in previous investigations of typically developing children), (b) the extent to which a brain measure of word processing derived from the response to CDS word stimuli was associated with a concurrent measure of receptive language, and (c) whether this association was conditional on the child's tendency to attend to CDS.
Methods: This study was a secondary analysis of data collected from a longitudinal study of preverbal children with ASD. Thirty-four children with ASD aged 2-5Â in preverbal or early verbal stages listened to a set of 10 words typically understood by infants aged 8-12 mo, and 10 nonsense words (Mills et al., 2004), while ERPs were collected using dense-array EEG technology. All stimuli were recorded by a young, female, native speaker, using speech features characteristic of CDS, and presented 3 times each in random order. Receptive language was evaluated using MacArthur-Bates Communicative Development Inventories (MCDI; Fenson et al., 2007). Participants' level of attention to CDS was measured twice across the course of the longitudinal study using a structured procedure in which child-friendly stimuli that featured CDS were presented from a puppet theater (Watson et al., 2010). Scores from each administration were aggregated to create a single score representing the child's generalized tendency to attend to CDS.
Results: ERP amplitudes at the left temporal electrode cluster (~T3) between 200-500 ms were more negative for CDS words vs. nonword stimuli, indicating a typical neural response associated with word processing. The word-nonword amplitude difference was not significantly correlated withÂ receptive language (r =-.17), though the association was in the expected direction. However, further analyses indicated that this measure statistically interacted with attention to CDS (β = -0.47, p = 0.04): the association between word processing and receptive language was stronger for children who displayed moderate or high levels of attention to CDS compared to those who did not.
Conclusions: Children with ASD as a group do exhibit the typical neural response to word stimuli delivered in CDS. However, the utility of this measure as a correlate of language outcomes is conditional upon the child's tendency to attend to CDS. Further work is needed to understand whether subgroups of children with ASD may benefit from language interventions that use other types of speech.

121 **125.121** Towards a Neurocomputational Model of Sensory Differences in ASD

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Background:
ASD is associated with differences in sensory processing, including difficulties organizing sensory experiences (Dakin & Frith, 2005). Predictive processing theories of cognition explain these differences in terms of differences in statistical processing of sensory information in the brain. A core hypothesis of the predictive processing account is that people with ASD rely less on prior perceptual experience, and more on detailed sensory information, when making perceptual inferences about things in their environments (Pellicano & Burr, 2014). This account has been supported in recent experiments (Skewes et al, 2014; Skewes & Gebauer, 2016).
Objectives:
The purpose of the present research is to use computational modeling to pinpoint the specific mechanisms which underlie the tendency in ASD to rely less on prior sensory information.
Methods:
In the experiments cited above, participants are asked to make binary perceptual inferences given continuously distributed stimuli. For instance, in Skewes and Gebauer (2016), participants were presented with sounds which varied in the location of their spatial sources, and were asked to report whether each sound was produced by a "white" cricket, whose territory was distributed more towards the left auditory hemifield, or by a "black" cricket, whose territory was distributed more towards the right. Participants were given feedback at the end of each trial, and were rewarded for correct responses. Participants with ASD integrated prior information about the base-rates of each kind of cricket less optimally.
Drawing resources from Signal Detection Theory and Prospect Theory, we have developed a cognitive model of the processes underlying this integration. We model learning during the task as an interaction between 1) sensitivity to sensory error of judgements, and 2) sensitivity to feedback. This allows us to develop a deeper explanation of the functional differences identified for individuals with ASD.
To understand the neural mechanisms implementing these differences, we've adapted a neural network model designed to learn the same kind of perceptual inference required by the task (Helie, 2014). We used the experimental results to constrain simulations of the network. The results of these simulations allow us to make precise predictions about the neurobiological mechanisms underlying the functional differences observed in ASD.
Results:
In a novel pilot experiment designed to test our cognitive model, we found that autistic traits in the neurotypical population predicted sensitivity to feedback, but not sensitivity to sensory error. Based on this result, we adjusted the rate of learning in frontal GABAergic/dopaminergic synapses in the neural network, which represent the rate at which feedback drives learning in the model. Using simulations, we found that when the learning rate was set lower, the network performed in a way similar to participants in the cited studies.
Conclusions:
This research theoretically motivates the hypothesis that sensory differences in ASD result from differences in neurobiological mechanisms in frontal networks involved in learning about how to reduce continuous sensory information to informative perceptual categories.

122 **125.122** Interpersonal Predictive Coding Across the Autistic Spectrum

L. Schilbach*, Independent Max Planck Research Group for Social Neuroscience, Max Planck Institute of Psychiatry, Munich, Germany*

Background:
Action perception is not simply a reflection of what happens, but a projection of what will happen next. In this talk, the notion of interpersonal predictive coding will be introduced and reviewed in light of evidence from behavioral studies, which investigate the ability to use social information to learn from and predict others' actions by using point-light displays that depict communicative as compared to non-communicative actions between two agents. Furthermore, computational modeling was used in a second paradigm, which required individuals to learn about the probabilities of social and non-social cues and to integrate them in order to gain points in a card selection task. Objectives:
These studies aimed at investigating whether - in spite of intact performance on action recognition tasks - individuals with autism might show impairments of the ability to predict subsequent actions during an observed dyadic encounter. An additional aim was to characterize and quantify the processes that allow individuals to integrate social and non-social cues during decision-making.
Methods:
The first study used point-light displays that depict communicative as compared to individual actions between two agents and were taken from an established database. Agent A demonstrated either a communicative or an individual action while agent B either showed a communicative action or was not present. As part of this two-alternative forced choice paradigm, participants had to indicate whether they thought agent B had been present in one of two trials. Eyetracking measurements were also obtained.
In a second study the ability to integrate social and non-social information during decision-making was studied by making use of a probabilistic learning task in conjunction with Bayesian modeling to investigate autistic trait-related differences in basing one's decisions on social rather than non-social information. Using computational modeling a weighting parameter was calculated that indicated the extent to which participants were influenced by the social cues about which they had received no information during the instructions.
Results:
Using a two-alternative forced choice paradigm, it was shown that participants' sensitivity for detecting a second agent masked by noise signals was significantly higher when a first agent showed a communicative action. This measure of sensitivity also showed a negative and significant correlation with increasing autistic traits across the entire spectrum. Results from the second study show that autistic traits are negatively correlated with the extent to which decisions are based on social rather than non-social information. These autistic trait-related differences in cue integration also explained performance differences across different groups of participants.
Conclusions: Taken together, these findings highlight that autistic traits are related to differences in the integration, anticipation and automatic responding to social cues, rather than a general inability to register and learn from social cues. Importantly, such differences may only manifest themselves in sufficiently complex situations.

123 **125.123** Abnormal Functional Connectivity in the Social Brain Identified By a Generalized Classifier for Autism Spectrum Disorder

***R. Hashimoto**, Medical Institute of Developmental Disabilities Research, Showa University, Setagaya-ku, Japan; Department of Language Sciences, Graduate School of Humanities, Tokyo Metropolitan University, Tokyo, Japan*

Background: Autism spectrum disorder (ASD) has been increasingly conceptualized as a disease of functional brain networks. Among multiple nodes that constitute the brain's networks, several "social brain" regions have been proposed as key structures that particularly contribute to functional alterations in the ASD brain. However, because current standard analyses of functional connectivity (FC) are mainly driven by hypotheses related to deficits in interpersonal functions in ASD, highlight of abnormalities in the social brain may be an unsurprising consequence.
Objectives: In order to overcome potential biases of the present approaches, we adopted hypothesis-free data-driven analyses to a large cohort data of the resting-state FCs of adults with ASD collected at multiple sites and tested whether the importance of deficits in the social brain regions in ASD is supported without any hypotheses related to social functions.
Methods: Â We collected the resting-state FC data of 74 adult high-functioning ASDs and 114 typically-developed controls collected at three different MRI sites in Japan. From each participant, we generated a correlation matrix consisted of 9,730 FCs using a standard brain atlas. Using this set of the correlation matrices as input, we combined advanced statistical methods to develop a classifier consisted of a small number of FCs that distinguished between ASD and TD. We then examined the anatomical distribution of the regions included in the selected FCs of the classifier.
Results: We developed a classifier that incorporated as little as 0.16% of all the 9,730 FCs in the brain (16 FCs). This classifier turned out to distinguish between ASD and TD with high precision (85 %) for the data collected at the three Japanese sites. Furthermore, we observed the generalization of this classifier into the third cohort collected in the USA sites with 75% accuracy. Anatomical examination of the 16 FCs revealed a right-sided distribution (31% right intra-hemispheric FCs as opposed to absent left intra-hemispheric FC). Furthermore, the 32 brain regions comprising the 16 FCs contained most of the important nodes in the social brain network, including the right amygdala, superior temporal sulcus, cingulate cortex, orbitofrontal cortex, and inferior frontal cortex.
Conclusions: The results suggest that abnormalities of a small number of FCs underlie core ASD deficits. Our data-driven approaches highlight the importance of the social brain FCs in the ASD brain and provide complementary findings to standard hypothesis-driven approaches.

Poster Session
126 - Medical and Psychiatric Comorbidity
5:30 PM - 7:00 PM - Golden Gate Ballroom

124 **126.124** A Case for Including Adolescent Self Report of Sensory and Anxiety Symptoms in ASD: Evidence from Questionnaire and Autonomic Data

***J. M. Keith**[1], J. P. Jamieson[1], P. Allen[2] and L. Bennetto[1], (1)Clinical and Social Sciences in Psychology, University of Rochester, Rochester, NY, (2)University of Rochester Medical Center, Rochester, NY*

Background: Dysregulated sensory processing and anxiety are both highly prevalent clinical concerns for individuals with autism spectrum disorder (ASD). While it is clear that both sensory dysfunction and anxiety are present in individuals with ASD, accurately and fully measuring these symptoms is challenging, given that they are largely experienced internally. Furthermore, while past research has suggested that individuals with ASD have difficulty reporting on their internal states, parent report is also subject to limitations, such as reporter effects (e.g., bias, memory) and reliance on the ability to index internal emotions and sensory states based solely on observable behaviors.
Objectives: The current study used a multi-method approach to evaluate differences between child- and parent-report of sensory processing and anxiety symptoms in high-functioning adolescents with ASD and typically developing (TD) controls. To determine the relative validity of self- versus parent-report for identifying symptoms, we compared these questionnaires to objective, physiological measurements of the sympathetic and parasympathetic nervous systems during a laboratory sensory challenge.
Methods: Participants included 22 adolescents with ASD (mean age=14.5, range=12-17 yrs) and 18 TD controls (mean age=15.1, range=12-17 yrs). Diagnoses were confirmed using the ADOS and ADI-R in the ASD group and ruled out using the ADOS and SRS in the TD group. Groups were matched on age, gender, and Wechsler Verbal Comprehension Index. Each participant and their parent completed the Brain Body Center Sensory Scales and the Screen for Childhood Anxiety Related Disorders (SCARED). Electrocardiography, respiratory sinus arrhythmia, and electrodermal activity were collected at rest (baseline) and during a laboratory task presented in continuous, 75 dB gated broadband noise (sensory challenge).
Results: Group x Reporter ANOVAs were conducted for both sensory symptoms and trait anxiety. For both domains, the ASD group showed significantly higher symptoms than TD peers (sensory, F=41.27, p<.001; anxiety, F=30.15, p<.001). For both domains, there was also a significant effect of reporter. Children from both groups reported higher levels of sensory dysfunction than reported by parents, F=16.65, p<.001. An identical pattern emerged for the anxiety data, with children from both groups reporting higher levels of trait anxiety than their parents reported, F=18.27, p<.001. To better understand these reporter differences, we examined the relationship between questionnaire measures and autonomic arousal. Interestingly, in the ASD group, child-report of sensory (r=.55, p=.05) and anxiety (r=.49, p<.05) symptoms correlated with autonomic arousal levels, whereas parent-reports of these symptoms were not related to autonomic reactivity.
Conclusions: These results make a substantial contribution by demonstrating that high-functioning adolescents with ASD are able to accurately report on their internal experiences with sensory and anxiety symptoms, and that their report may reveal a greater degree of symptoms than reported by parents. The validity of child-reports in ASD was substantiated by demonstrating concordance between self-report of symptoms and autonomic arousal levels collected in the lab. Together, these results suggest that research and clinical evaluations of high-functioning adolescents with ASD should include the perspective of the individuals themselves as they are likely able to contribute a different and important perspective.

125 **126.125** A Network Perspective on the Relationship Between ASD and Depression Symptoms in Older Adults: The Role of Mastery & Worry

B. F. van Heijst[1], *M. K. Deserno*[1], *H. C. Comijs*[2] *and H. M. Geurts*[1], *(1)University of Amsterdam, Amsterdam, NETHERLANDS, (2)Psychiatry, GGZ inGeest, Amsterdam, Netherlands*

Background:
ASD and depression often co-occur: adults with ASD have a high incidence of depression (Croen et al., 2015; Lever & Geurts, 2016) and among depressed older adults, ASD characteristics are much higher than for non-depressed older adults (Geurts, Stek & Comijs, 2016). However, what remains unclear is how depression and ASD relate to each other. By using network analyses we aim to determine whether ASD and depression symptom clusters are strongly interconnected or whether this co-occurrence is due to a mutual relationship (i.e., bridge symptom-cluster) with another construct. We hypothesize that the latter is the case. As there is a strong connection of mastery (perceived control over life's stressors) and worry with depression, these are likely candidates to serve as bridge symptom-clusters.
Objectives:
To gain insight into the relationship between ASD and depression, and investigate the role of mastery and worry.
Methods:
We made use of an existing dataset from The Netherlands study of depression in older persons (NESDO; Comijs et al., 2011) that focused on depressed and non-depressed older persons (N=376, age M=69.9, 60-90 years) without an ASD diagnosis. Participants were assessed on ASD symptoms (AQ-28), depression severity (IDS-SR), worry (Worry Scale-R) and mastery (Pearlin Mastery Scale). The structure of the association network and centrality indices are the outcome measures. Further analysis (e.g. network reliability, concentration network) will be completed before the IMFAR conference.
Preliminary Results:
Visual inspection of the network shows some direct connections between ASD and depression, the strongest direct relation is between Motivation (IDS-SR) and Routine (AQ-28). ASD (AQ-28) relates to Worry. However, this is specific for Social Worry, which has the strongest connection to Social Skills (AQ-28). Social Worry further connects to depression (IDS-SR), and Mastery. Centrality analysis show that Mastery ranks among the most central nodes in the network.
Preliminary Conclusions:
Mastery so far seems to be a more likely candidate as a bridge symptom than worry per se, although social worries also play an important role. However, there is also a clear direct relationship between ASD and depression. Although speculative, the feeling of being in control of life's stressors, and worries about one's social life could both be important targets when treating people with depression and ASD. A future research avenue is to determine whether a similar network can be replicated in ASD sample. It is, however, likely that networks converge across different samples.

126 **126.126** ADHD Severity As It Relates to Comorbid Psychiatric Symptomatology in Children with ASD

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Background:
A growing body of research suggests that the prevalence rate of psychiatric comorbidity in individuals with ASD is much higher than it is in in the general population. Additional evidence suggests that ADHD contributes additional impairments in functioning. Not enough is known about the impact of ADHD on the development of comorbid psychiatric syndromes, or whether children with ASD who have more severe symptoms of ADHD are at higher risk for comorbid psychiatric symptomatology than are children with ASD who have milder ADHD symptoms.
Objectives:
The objectives of this study were to: 1) examine the rate of comorbid psychiatric disorders--including disruptive behavior disorders, mood disorders, anxiety disorders, elimination disorders, and eating disorders in children with ASD; and 2) determine if higher severity of ADHD symptomatology in children with ASD was associated with higher levels of psychiatric comorbidities and syndrome severity. It was hypothesized that children with ASD who have higher levels of ADHD symptom severity would be at higher risk for comorbid psychiatric diagnoses and symptomatology.
Methods:
Participants were 99 children (78 boys; mean age=9.4 yrs.; mean SB5 Full Scale IQ=84) who met DSM-IV criteria forÂ ASD on the ADI-R and the ADOS.Â Analysis ofÂ ADHD severity (as assessed by Conners' Rating Scale-Revised; Parent Version; global index) as a predictor of the number of comorbid diagnoses (using Diagnostic Interview for Children and Adolescents-Fourth Edition; DICA-IV) were examined using multiple regression analyses, with mental age (SB-5 FSIQ age equivalent) as a covariate. A regression model was then used to analyze the effect of ADHD severity on Child Behavior Check List (CBCL) symptom severity using eight subscale T scores as dependent variables (anxious/depressed, withdrawn, somatic complaints, social problems, thought problems, attention problems, rule breaking behavior, and aggressive behavior), with mental age as a control.
Results:
More severe ADHD symptomatology was associated with having more comorbid psychiatric diagnoses on the DICA-IV, $F(1,95)=9.04$, $p= 0.003$. More severe ADHD severity was also associated with higher levels of symptom severity on CBCL syndrome subscales, $F(8, 88) = 23.56$, $p<0.001$. Specific areas of concern included Disruptive Behavioral Disorders, Anxiety Disorders, Mood Disorders, Elimination Disorders, Eating Disorders, and Separation Anxiety Disorder. Interestingly, increasing severity of autistic symptomatology (as measured by ADI-R) was not associated with higher risk of comorbid psychiatric diagnoses or CBCL syndrome severity. These findings suggest that ADHD severity--but ASD severity--is associated with a higher risk for comorbid psychiatric symptomatology in children with ASD.
Conclusions:
These results suggest that children with ASD who also have severe ADHD symptoms are at high risk for a other psychiatric comorbidities. Not only did we find that a greater number of psychiatric diagnoses were associated with ADHD in children with ASD, but also that more severe ADHD symptoms led to more severe psychiatric symptoms in these children. It is interesting to note that ASD symptomatology was not associated with a higher risk for psychiatric comorbidity or severity. These results lend support to the notion that greater ADHD symptoms is a risk factor for greater comorbid psychiatric problems in children with ASD.

127 **126.127** ADHD Symptomatology in Preschoolers with Fragile X Contrasted to Idiopathic Autism

S. L. O'Connor[1]*, A. L. Hogan*[2]*, K. E. Caravella*[2]*, S. M. Matherly*[2] *and J. Roberts*[1]*, (1)Department of Psychology, University of South Carolina, Columbia, SC, (2)University of South Carolina, Columbia, SC*

Background:
Attention Deficit/Hyperactivity Disorder (ADHD) is the most commonly diagnosed behavioral disorder in children, with about 11% of the general population diagnosed with ADHD. Symptoms of ADHD, such as inattention, hyperactivity and impulsivity, are present at elevated rates in children with fragile X syndrome (FXS) and autism spectrum disorder (ASD). Estimates of ADHD in school-age children fall around 60% for youth with FXS and up to 53% in ASD. Screening for comorbid disorders in these high risk groups is important to aid in diagnostic determination along with accessing and directing treatment. To our knowledge, no study has examined ADHD symptom presence or severity in preschoolers with FXS or compared the severity of ADHD symptomatology between children with ASD and FXS despite the high prevalence and significant impact ADHD has on these populations.
Objectives:
In the present study we characterize ADHD symptom severity across three groups of preschool-aged children: FXS, ASD and typically developing (TD) controls. This study also investigates the effect of ASD severity on the impact of ADHD symptoms in the FXS group. The effect of sex was also investigated across all three groups.
Methods:
Participants included 22 children with FXS, 18 children with ASD and 18 TD children between the ages of 3-6 years old (boys' n = 46, girls' n = 12; Age M = 53.23, SD = 11.11). The Child Behavior Checklist 1½-5 ADHD-DSM subscale raw and t-scores (CBCL) were used to assess the presence and severity of ADHD symptoms. Cognitive functioning was measured by the Early learning composite (ELC) on the Mullen Scales of Early Learning (MSEL). Autism symptom severity was measured by the Autism Diagnostic Observation Schedule (ADOS-2).
Results:
Two ANCOVA's were run. Both sex and Mullen ELC were co-varied in the analyses. Results show no differences in mean scores across the three groups for both the ADHD DSM scale raw and T-scores on the CBCL (p > .05). No effect of sex was found. To investigate the effect of autism symptomology on CBCL ADHD DSM subscale scores, Pearson's correlations were calculated to look at the effect of autism severity on ADHD raw and t-scores for the FXS group. No significant relationship was found between autism severity and ADHD symptoms in the FXS group (p > .05).
Conclusions:
The present study findings suggest that group differences on ADHD symptomology are not evident at the preschool age for these clinical samples. This finding is striking as rates of ADHD in school age samples are much higher in both FXS and ASD compared to TD peers. These findings are important and indicate that early indicators of ADHD may be muted during the preschool years or that severity of ADHD symptoms may increase dramatically across early childhood. Thus, diagnostic surveillance for ADHD is important in ASD and FXS to detect symptom severity and impairment that may emerge at older ages than community samples. This work also suggests that treatment may be initiated in the absence of overt symptoms to minimize the severity of later-emerging symptomology.

128 **126.128** ASD and ID: Results from a National Study of ID of Genetic Origin

R. Srinivasan[1]*, J. Wolstencroft*[1]*, D. H. Skuse*[2] *and I. D. IMAGINE Consortium*[3]*, (1)UCL GOS Institute of Child Health, London, United Kingdom, (2)UCL GOS Institute of Child Health, London, UNITED KINGDOM, (3)UCL GOS Institute of Child Health, IMAGINE ID, London, United Kingdom*

Background: Intellectual disability (ID) is characterised by significant limitations in cognitive functioning and adaptive behaviour. Many people with ID experience significant behavioural difficulties or mental health problems. IMAGINE-ID, is a recently established national UK study of psychiatric risk in ID of known genetic origin, with up to 10,000 participants. Here, we investigate the association between ID and ASD in the general population, and the prevalence of comorbidities including Anxiety Disorders, Disruptive Behaviour Disorders (DBD), Attention-Deficit/Hyperactivity Disorder (ADHD) and Tic Disorders.
Objectives: In the initial phase of this program, our focus has been on children (4-18 years) with ID that is associated with pathogenic Copy Number Variants (CNV), ascertained by NHS Regional Genetics Centres. By means of online/in-person phenotyping, we aimed to assess the prevalence of ASD, and contrast psychiatric comorbidities in those with and without ASD.
Methods: Over 900 participants with ID of genetic cause confirmed by microarray have so far been recruited into IMAGINE-ID. 651 assessments have been completed and 330 completed assessments have been clinically rated to date (over 1000 by May 2017). A standardized psychiatric interview, the Development and Wellbeing Assessment (DAWBA), is administered to caregivers; this generates probability scores for DSM-5 rated psychiatric symptomatology, including ASD. The DAWBA has been used in the UK's national studies of child psychiatric adjustment. Genetic aetiology has been established: i) by microarray analyses (UK NHS accredited laboratories, with array resolutions typically 200kb); ii) aetiological SNV identified from the UK Deciphering Developmental Disorders survey.
Results: 31% of participants met criteria for a diagnosis of ASD. The male: female ratio in those with ASD was 3:1 but in the non-ASD group the sex ratio was equal. Mean age overall was 8.9 years (SD=3.8, range 4-18 years), with no significant differences in age, estimated mental age or language age between children with and without ASD. Participants with ASD were significantly more likely to meet DSM-5 criteria for an additional mental health disorder (36% vs 19%; p = 0.00) especially Anxiety Disorders (15% vs. 6%, p = 0.01), and Tic Disorders (4% vs. 1%, p=0.04). There were no significant group differences in the prevalence of ADHD or DBD. The Everyday Feelings Questionnaire (EFQ) measures impairment in caregiver emotional adjustment, and was completed by all participant parents. EFQ scores were higher for both ASD/non-ASD groups than the general population. Impairment was significantly greater in parents of children with ID+ASD (M=18.7 vs 15.9; p=0.00).
Conclusions: IMAGINE-ID is the first study to systematically evaluate the prevalence of ASD in a national cohort of children with ID of known genetic origin. A higher proportion of participants in IMAGINE ID display clinically significant ASD traits than identified in national UK studies (using the DAWBA) with children with ID of unknown aetiology. When associated with ASD, children with ID were more likely to have additional psychiatric comorbidities, especially Anxiety Disorders and Tic Disorders. The emotional impact of caring for a child with ID is increased in the presence of comorbid ASD.

129 **126.129** Adaptive Behavioral Dysfunction Is Associated with Increased Risk for ASD Symptoms in Toddlers with Tuberous Sclerosis Complex.

D. A. Pearson[1], *M. L. Kellems*[1], *S. S. Hashmi*[2], *H. Northrup*[2], *D. A. Krueger*[3], *A. W. Byars*[3], *D. S. Murray*[4] *and M. Sahin*[5], *(1)Psychiatry & Behavioral Sciences, University of Texas McGovern Medical School, Houston, TX, (2)Pediatrics, University of Texas McGovern Medical School, Houston, TX, (3)Neurology, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (4)Autism Speaks, Boston, MA, (5)Neurology, Boston Children's Hospital, Boston, MA*

Background:
Previous research has suggested that up to 50% of newborns with Tuberous Sclerosis Complex (TSC) will go on to develop autism spectrum disorder (ASD). Given that Tuberous Sclerosis Complex (TSC) can be diagnosed with 95% accuracy via prenatal ultrasonography, TSC offers a unique opportunity to study the early development of ASD. The goal of an ongoing multi-center study is ascertain possible biomarkers that could distinguish infants with TSC who will develop ASD from infants with TSC who do not develop ASD. Potential biomarkers being assessed in this project include imaging, EEG, genetic analysis, assorted clinical measures, and neurodevelopmental assessment measures (including adaptive behavior and behavioral/emotional function). Adaptive behavior deficits have long been associated with suboptimal developmental outcomes. Behavioral problems (e.g., inattention, social withdrawal), can significantly undermine adaptive functioning—which in turn undermines long-term educational, social, and occupational adjustment. At this point, little is known about the relationship between adaptive function and psychopathology in toddlers with TSC—especially with regard to symptoms, such as social withdrawal and emotional reactivity, that are closely associated with ASD.
Objectives:
The goal of this project was to determine if lower adaptive function is associated with higher levels of behavioral and emotional problems—especially symptoms closely associated with ASD-- in toddlers with TSC.
Methods:
Sample consisted of 66 toddlers (35 boys) participating in the TSC Autism Center of Excellence Research Network (TACERN). Mean age was 24.2 months, mean MSEL Composite was 79.6, and 14 had been diagnosed with ASD) by this point in the study. Adaptive function was assessed using the Vineland Adaptive Behavior Scale (VABS-II). Behavioral/emotional problems were assessed using the Child Behavior Checklist (CBCL, ages 1.5-5 years). Parents served as the informants for both instruments. Correlational analyses assessed the relationship between adaptive function and behavioral/emotional function.
Results:
Toddlers with TSC who had lower levels of adaptive function had significantly higher levels of behavioral and emotional concerns. Weaker adaptive function was associated with higher levels of internalizing problems (p<.001) and externalizing problems (p=.04). Of particular note were specific concerns in the areas of, pervasive developmental problems (p<.001), emotional reactivity (p=.022), and social withdrawal (p<.001). Other concerns associate with weak adaptive function included attention problems (p=.005) and affective problems (p=.002). When toddlers with ASD were removed from the sample and correlations re-run, weaker adaptive function was still associated with pervasive developmental problems (p=.001) and social withdrawal (p<.001), suggesting that these findings were not entirely driven by toddlers who had already been diagnosed as having ASD. However, it is possible that ASD had not yet been diagnosed in some of the 24-month old toddlers in this same—an empirical question to be addressed in subsequent neurodevelopmental evaluations.
Conclusions:
Even as early as 24 months old, toddlers with TSC who have weak practical living skills are at high risk for behavioral/emotional concerns that are associated with ASD, underscoring the need for early behavioral intervention for these toddlers in order to optimize developmental outcomes.

130 **126.130** Adaptive Functioning and Illness/Injury Coping in Children and Adolescents with Autism Spectrum Disorder

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Background: In children and adolescents (youth) with autism spectrum disorder (ASD), adaptive skills are often less well-developed than predicted by age and estimated IQ. Although social and communicative behaviours are the adaptive functioning domains typically most affected in ASD, daily living skills – including self-care, health, and safety behaviours – can also be compromised. Prior to this study, none had examined how the adaptive functioning of youth with ASD relates to illness/injury coping behaviours.
Objectives: We sought to better understand the relationship between adaptive functioning and illness/injury coping strategies in youth with ASD.
Methods: Participants were 24 youth with ASD (21 male), 24 age-, sex-, and IQ-matched typically developing (TD) youth (19 male), aged 10 to 17 years, and one parent for each ASD and TD participant (22 and 24 female, respectively). The Adaptive Behavior Assessment System – Second Edition (ABAS-II) was used to assess youth adaptive functioning. A semi-structured interview was administered to youth in order to assess illness/injury knowledge, both generally (e.g., illness/injury causality, symptom recognition, treatment, prevention) and in relation to specific ailments (e.g., cold, concussion, meningitis). Parent and self-reports of illness/injury coping were obtained using vignettes depicting characters with various ailments. The ailments consisted of illnesses, symptoms, and injuries that were balanced in terms of seriousness and frequency of occurrence, as determined by ratings from health care providers. Parents were asked to answer open- and closed-ended questions about how their children would cope with each condition.
Results: ABAS-II scaled scores were lower in the ASD group than in the TD group for all composite and subscales, including the Practical composite, which focuses on daily living skills and incorporates Health and Safety and Self-care subscales. There were no significant between-group differences in general or specific illness knowledge. Parents of youth with ASD described their children as displaying less active coping than their TD peers (60% vs. 93%, respectively), both with respect to general (e.g., information-, help-, and support-seeking) and specific (e.g., seeking out over-the-counter medications and ointments, requesting a physician visit) strategies. Youth with ASD were also reported to engage in more passive (e.g., emotionality, self-isolation) coping when ill/injured, compared to their TD peers (42% and 25%, respectively). Notably, use of specific active coping strategies was highly positively correlated with the Practical composite of the ABAS-II (r = .54). However, no relationship was found between use of general active coping strategies and the ABAS-II Practical composite (r = -.12).
Conclusions: Despite similarity in age, estimated IQ, and illness knowledge, youth with ASD and their TD peers demonstrated different illness coping patterns. Not surprisingly, youth with ASD who struggled more with daily living skills were reported to demonstrate fewer active coping strategies when ill/injured. However, this difference was restricted to specific and not general coping behaviours. Our results support the notion that personal care when ill falls within the broader construct of daily living skills, but suggest that actively seeking caregivers for assistance when ill/injured may be a particularly important behaviour to monitor in youth with ASD.

131 **126.131** Age-Based Patterns of Parent-Reported Medical and Behavioral Problems in Children and Adolescents with ASD

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Background:
Medical and behavioral problems are common in autism spectrum disorder (ASD); however, prevalence may vary by child's age and cognitive and verbal functioning.
Objectives:
To compare select medical and behavioral problems recently experienced by young children and adolescents with ASD, as reported by their parents
Methods:
Parent participants in the Interactive Autism Network (IAN)— a large, validated and verified, internet-mediated parent-report research registry—completed the Birth and Diagnosis Questionnaire (BDQ) on their child(ren) with ASD. The BDQ collects baseline data relating to each child's birth, ASD diagnosis, and development. In addition, the BDQ asks about the degree ("None", "Mild", "Moderate", or "Severe") to which the child has experienced 15 common medical/behavioral conditions associated with ASD during the past 30 days. See Table 1 for list of conditions. Parents were also asked to characterize their child's current level of functioning, including cognitive and verbal ability. A rating of "significantly below age level" on the cognitive functioning question was used as a proxy for intellectual disability (ID). A rating of "meaningful, fluent speech" was used to determine whether the child had normal verbal ability. Respondents were grouped into young children (6 to 10) and adolescents (ages 13 to 17). Children all had a professional diagnosis of ASD and a confirmatory score on the Social Communication Questionnaire >=12. Ordered Logistic Regression was performed on responses to the 15 condition questions by age group and degree of condition severity ("None", "Mild", "Moderate", or "Severe"). Control predictor variables included in the models were: Intellectual Disability; Normal Verbal Ability; Gender; Race; and Ethnicity.
Results:
Young Children (6-10 years): n=680; 80.4% male; 83.1% white; 10.3% Hispanic; mean (SD) age 8.6 (1.45) years; Adolescents (13-17 years): n=641; 81.6% male; 85.3% white; 11.2% Hispanic; mean (SD) age 15.1 (1.38) years. There was no statistical significant different in gender, race, or ethnicity.
See Table 1 for responses for each condition and the results of the Ordered Logistic Regression.
The areas of difficulty with the highest prevalence for both age-groups were: difficulty controlling emotions; irritability/aggression; hyperactively and impulsivity; anxiety; sensitivity to sounds; and sensitivity to textures/touch.
Young children experience more difficulties in: irritability/aggression; difficulty controlling emotions; self-injurious behavior; hyperactivity and impulsivity; movement/coordination; feeding; bowel movements; placing self in danger; placing others in danger; and elopement. Adolescents experienced a higher rate of depression. There was no age-related difference for: anxiety; sleep problems; sensitivity to sounds; and sensitivity to touch.
Intellectual Disability and/or abnormal verbal development were associated with 13 of the 15 factors. Gender in combination with cognitive and verbal functioning was associated with the following: depression (female + normal verbal development), anxiety (female + ID); and hyperactively and impulsivity (male + ID).
Conclusions:
Parents of young children report more challenges for their children than reported for adolescents in behavior, coordination, GI concerns, and safety, while adolescents had greater problems with depression. Professionals should provide age-based anticipatory guidance and health and behavior surveillance for early identification and treatment of these conditions.

132 **126.132** Altered T Cell Subsets in Children with Autism Spectrum Disorders and Co-Morbid Gastrointestinal Symptoms

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Background: The existence of gastrointestinal (GI) symptoms in children with autism spectrum disorders (ASD) has been estimated to occur 6 to 8 times more often than in typically developing children. The most commonly reported symptoms include: diarrhea, constipation, alternating bowel habits, gassiness or bloating, vomiting, and abdominal pain. While intestinal inflammation, altered microbiome profiles, and impaired intestinal permeability have been observed in children with ASD who experience GI symptoms, mechanisms underlying GI symptoms in ASD and relationship with behavioral phenotypes or other comorbid symptoms is still poorly understood.
Objectives: To characterize and assess T cell populations in children with ASD with and without GI co-morbidities, and the association with behavioral symptoms.
Methods: Children were recruited from the CHildhood Autism Risk from Genetics and the Environment (CHARGE) study and placed into one of four study groups based on responses from the GI symptom survey (adapted from standardized Rome III Diagnostic Questionnaire for the Pediatric Functional GI Disorders): children with ASD who experience GI symptoms of irregular bowel habits (ASD^{GI}) and children with ASD who do not have a history of GI symptoms (ASD^{NoGI}) compared to typically developing children with GI symptoms (TD^{GI}) and typically developing children without a history of GI symptoms (TD^{NoGI}). Peripheral blood mononuclear cells (PBMC) were isolated from participant's blood, stimulated *in-vitro* for 4 hrs and stained for surface markers and intracellular cytokines for flow cytometry; including markers for T cell subsets and for β7, part of the α4β7 integrin that is upregulated on lymphocytes homing to the GI tissue. Behavioral assessments and diagnosis were performed by trained clinicians and included Autism Diagnostic Observation Schedule (ADOS), Autism Diagnostic Interview – Revised (ADI-R) and Aberrant Behaviors Checklist (ABC) scores.
Results: Flow cytometric analysis revealed several differences between groups. Children in the ASD^{GI} group had significantly decreased regulatory T cells (T_{regs}), identified as $CD25^{+}Foxp3^{+}$ T cells, compared to ASD^{NoGI}, furthermore, ASD^{GI} children were found to have a lower frequencyof gut homing T_{regs} ($B7^{+}CD25^{Hi}$ cells) compared to TD^{NoGI}, whereas both ASD groups were found to have reduced number of $IL\text{-}10^{+}$ T cells compared to TD^{NoGI}. However, ASD^{GI} children had the highest percentage of $IL\text{-}17^{+}$ CD4 T cells compared to all other groups, while ASD^{NoGI} displayed the highest percentage of $IL\text{-}13^{+}$ CD4 T cells. In addition to changes in T cell populations, children in the ASD^{GI} group displayed increased aberrant behaviors, as indicated by increased scores on the ABC subscales for: Irritability, Hyperactivity and Social Withdrawal.
Conclusions: Children with ASD displayed deficits in regulatory T cell populations compared to typically developing controls, regardless of the presence of GI symptoms, however, the ASD^{GI} group had the lowest T_{reg} population numbers. Interestingly, the two ASD groups differed in T helper subset populations with ASD^{GI} children displaying more of a T_H17 phenotype (elevated $IL\text{-}17^{+}$ T cells), whereas ASD^{NoGI} exhibited more of a T_H2 phenotype (elevated $IL\text{-}13^{+}$ T cells), suggesting that children with ASD may have deficits in immune regulation that may lead to elevated inflammatory T cell subsets.

133 **126.133** Anxiety Disorders in Adults with Autism: A Population-Based Study.

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Background: Anxiety is common in children with autism, but studies of the prevalence of specific anxiety disorders in adults with autism are limited. It has been suggested that anxiety disorders may be more prevalent in autistic individuals without intellectual disability, who may have more insights into their problems. Furthermore, autism may be genetically linked to anxiety disorders, but few studies have examined the rates of anxiety disorders in non-autistic full and half siblings of individuals with autism.
Objectives: 1) To assess the associations of autism with adult anxiety disorders compared with the general population. 2) To study whether the associations are different for people with autism with and without intellectual disability. 3) To examine the risk of anxiety disorders in non-autistic full and half siblings of probands with autism, compared to the general population.
Methods: The Stockholm Youth Cohort comprises persons aged 17 years or younger who had ever lived in Stockholm County, Sweden, from January 1, 2001, until December 31, 2011. We included cohort members aged 18 or older on December 31, 2011 who had ever received a diagnosis of autism (nâ€‰=â€‰3544) and their full and half-siblings never diagnosed as having autism. Of the 3544 individuals with autism we distinguished the 1046 with intellectual disability from those without intellectual disability (n= 2498). We calculated risk ratios (RRs) for all anxiety disorders ascertained using registers from outpatient and inpatient public service use, adjusted for parental age; highest parental education; household income; whether the child or either of their parents were born abroad; parental mental illness; sex and age at end of follow up.
Results: Â Around a fifth (20.8%) of people with autism had an anxiety disorder diagnosed in adulthood, compared to 8.6% of the general population (RR= 2.76, 95% CI 2.58-2.94). Individuals with autism without intellectual disability were much more frequently diagnosed with anxiety disorders in adulthood (24.38%), than those who had autism with intellectual disability (12.24%). The adjusted RRs for all anxiety disorders for people with autism without intellectual disability was 3.16 (95% CI, 2.95-3.38); whereas those for people with autism and intellectual disability were 1.72 (95% CI, 1.47- 2.02). Non-autistic full siblings of people with autism also had a greater risk of anxiety disorders than the general population [RR 1.35 (95% CI, 1.22- 1.48)] but there was no evidence for an increased risk of anxiety disorders for non-autistic half-siblings (RR = 1.03; 95% CI, 0.83-1.27) as compared to the general population.
Conclusions: People with autism without intellectual disability have notably higher rates of anxiety disorders diagnosed in adulthood than the general population, and than individuals with autism and intellectual disability. The associations with anxiety disorders were highest in individuals with autism, followed by non-autistic full siblings and lowest in non-autistic half siblings suggesting that greater genetic load for autism may increase the risk for anxiety disorders.

134 **126.134** Anxiety Disorders in Preschool Age at Risk Children: Autism Siblings and Fragile X Syndrome

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Background: Anxiety is one of the most common co-morbid conditions presenting in individuals with autism spectrum disorder (ASD), with up to 66% meeting criteria for at least one disorder. In groups at high risk for ASD, such as infant siblings and individuals with fragile X syndrome (FXS), rates of anxiety have also been identified as elevated. In FXS, rates of anxiety disorders are reported to occur at a rate of 86% of individuals with FXS over the age of 5 meeting criteria for at least one anxiety disorder. In infant siblings without ASD, rates of anxiety are found to be greater than controls, however prevalence rates have not been reported in a preschool age sample.
Objectives: This study aimed to examine preliminary prevalence rates of anxiety disorders in a preschool age sample of two groups at high risk for developing ASD, ASIBs and individuals with FXS, compared to a chronologically age matched control sample.
Methods: The mothers of 58 children ages 3-6 (11 autism siblings (ASIB), 25 controls and 22 children with FXS) were administered the Preschool Age Psychiatric Assessment (PAPA) at one time point. The PAPA is a semi-structured diagnostic interview that measures symptoms consistent with DSM-IV childhood disorders and requires in-depth research training. The anxiety disorders domain was used in the analysis, which includes the following domains: Separation Anxiety Disorder, Specific Phobia, Generalized Anxiety Disorder and Social Phobia. PAPA algorithms provide a dichotomous output representing whether symptoms did or did not meet criteria for each disorder.
Results: Anxiety disorders occurred at a rate of 18% (n=2) in the ASIB group, 36% (n=9) in the control group, and 68% (n= 15) in the FXS group. Across all groups, Specific Phobia was the most commonly endorsed disorder, with all but one participant who met who an anxiety disorder (FXS), meeting criteria for Specific Phobia. Rates of the other anxiety disorders occurred at the following rates across the ASIB, control and FXS groups respectively; Generalized Anxiety Disorder: 18%, 9%, 23%, Separation Anxiety Disorder 9%, 8%, 5% and Social Phobia 9%, 16%, 32%.
Conclusions: This study is the first to examine rates of anxiety disorders in a preschool age sample of individuals with FXS and high risk autism infant siblings. Specific phobia had the highest prevalence across all groups, which inflated the summary level prevalence rates of anxiety disorders universally. The high rates of specific phobia may be due to its transient nature in childhood, which may represent a more developmentally appropriate fear response, rather than a stable anxiety disorder. Consistent with previous literature, rates of anxiety disorders were highest among the FXS group. In contrast with previous literature, ASIBs in the sample did not show elevated rates of anxiety compared to the control group, however interpretation is considered preliminary given the small sample size of ASIBs.

135 **126.135** Are Autistic Traits Associated with Suicidality in General Population Young Adults? a Test of the Interpersonal-Psychological Theory of Suicide.

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Background: Autism Spectrum Conditions (ASC) have recently been associated with increased risk of suicidality. However, no studies have explored how autistic traits may interact with current models of suicidal behaviour in the general population. This limits our understanding of possible risk and protective factors for suicide among those with ASC, and impedes development of appropriate risk assessments and suicide prevention strategies. The Interpersonal-Psychological Theory of Suicide (IPTS) is potentially a strong candidate for conceptualising the movement from suicidal thoughts to behaviours in relation to autistic traits, given its focus on difficulties which are commonly associated with ASC.
Objectives: To establish how self-reported autistic traits interact with perceived burdensomeness and thwarted belongingness in predicting suicidal behaviour, in the context of the Interpersonal-Psychological Theory of Suicide (IPTS).
Methods: The sample was comprised of 163 general population young adults (aged 18-30 years). Participants completed an online survey including self-report measures of thwarted belonging and perceived burdensomeness (Interpersonal Needs Questionnaire), autistic traits (Autism Spectrum Quotient), current depression (Centre for Epidemiological Studies Depression Scale), and lifetime suicidality (Suicide Behaviour Questionnaire-Revised).
Results: Results showed that burdensomeness and thwarted belonging significantly mediated the relationship between autistic traits and suicidal behaviour. Both depression and autistic traits significantly predicted thwarted belonging and perceived burdensomeness. Autistic traits did not significantly moderate the relationship between suicidal behaviour and thwarted belonging or perceived burdensomeness.
Conclusions: Results suggest that the IPTS provides a useful framework for understanding the influence of autistic traits on suicidal behaviour. Autistic traits present in the general population are associated with increased risk of suicidality. Feelings of not belonging in the world, being a burden on friends and family, and depression are all associated with autistic traits, and account for the association between autistic traits and suicidality. The psychometric properties of these measures need be explored in those with clinically confirmed diagnosis of ASC, in order to replicate and extend these findings. However, clinicians need to be aware of increased risk of suicidality in those with high autistic traits, and when present, screen for suicidal thoughts, behaviours, and feelings of belonging, burden and low mood.

136 **126.136** Arousal Dysregulation in Children with Autism Spectrum Disorder

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Background: Substantial heterogeneity exists in the degree of impairment, the collection of behavioral symptoms and the medical conditions associated with Autism Spectrum Disorder (ASD). Identifying explicit ASD phenotypes based on a constellation of symptoms may lead to greater understanding of the causal mechanisms of ASD and precise treatments. Arousal dysregulation in children with ASD may produce symptoms including anxiety and insomnia.
Objectives: The purpose of this study was to investigate the relationship between anxiety, biomarkers of arousal dysregulation and sleep parameters in ASD versus typically-developing controls (TDC). We hypothesize that individuals with ASD and anxiety as compared to individuals with ASD without anxiety and TDC will have: (1) greater rate of insomnia, defined as difficulty falling and maintaining sleep with daytime impairment, and a sleep latency of greater than 30 minutes as measured by actigraphy; (2) greater sleep latency, decreased sleep efficiency; (3) higher levels of urine catecholamines; (4) lower Respiratory Sinus Arrhythmia score.
Methods: Setting: Home and center visit at the Center for Autism Research (CAR) at the CHOP. Anxiety diagnosis was made with Anxiety Disorders Interview Schedule. Sleep parameters included CSHQ and 7 nights of actigraphy. Biomarkers of arousal dysregulation included urine catecholamine diurnal samples. Respiratory Sinus Arrhythmia (RSA) was obtained using a BioHarness ECG system taking a clean 5-minute interval from a 30-minute session at the CAR lab.
Results: Sample = 57 ASD, 15 TDC, ages 6-18.
47% of ASD subjects had anxiety. 53% of ASD subjects had insomnia. Our sample had a significant relationship between anxiety and insomnia (X^2<.0001): 88.9% of children with ASD and anxiety also had insomnia, while insomnia was present in only 20% children with ASD without anxiety. In order to identify the relationship between a phenotype of arousal dysregulation and biomarkers, we separated the cohort into two groups: Group A including children with ASD without anxiety and no insomnia (n=24), and Group B including children with ASD, anxiety and insomnia (n=24).
ASD cohort had longer sleep latency than TDCs (30.5 min vs. 19.8 min, p=.025). Group A sleep latency was 19.7 min, and Group B sleep latency was 40.1 min (p=.001).
Group B had a higher CSHQ score than Group A (p=.082), specifically sleep anxiety (p=.072) and daytime sleepiness (p=.039). Group B sleep onset delay and sleep anxiety scores were greater than TDC (p=.065, p=.026).
Total sample mean evening urine epinephrine level was 9.39 µg/g creatinine, with Group A 7.57 µg/g creatinine, Group B 12.43 µg/g creatinine, and TDC 7.62 µg/g creatinine. Reference epinephrine level for children aged 10-15 years is 8 µg/g creatinine (Pussard). Urine epinephrine levels were greater in Group B than in TDCs and Group A (p=.1628).
Group B had lower RSA than Group A (6.1 vs. 6.9, p=.035).
Conclusions: Â A potential link between insomnia and anxiety in children with ASD was found. Sleep latency differed significantly between TDC and ASD, with Group B having the longest sleep latency. Increased epinephrine in evening urine and lower RSA support a hypothesis of an arousal dysregulation phenotype in children with ASD.

137 **126.137** Assessment of Suicidal Risk in Children and Adolescents with Autism Spectrum Disorder Presenting to a Pediatric Emergency Department

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Background: Assessment of suicidal risk in children and adolescents with autism spectrum disorders (ASD) is a challenge due to their limited verbal and communicational skills. The existing body of literature mainly focuses on youth with ASD in community and hospital settings. Results indicate a higher rate of suicidal ideation in youth with ASD compared to control subjects. Potential risk factors for suicidality in this population include the absence of intellectual disability, a history of trauma, and the presence of co-morbid psychiatric disorders. Research on assessment of suicidal risk among children and adolescents with ASD presenting to the emergency department (ED)is scarce. Given the high rates of ED use in youth with ASD and the challenges with eliciting suicidality, developing methods to assess suicidal ideation in ED settings is critical in order to determine the most safe disposition plan (Kalb et al., 2012).
Objectives:
1. To compare the efficacy of the Ask Suicide Screening Questionnaire (ASQ) versus general screening at triage when assessing suicidal risk in children and adolescents with ASD in the ED setting.
2. To analyze the primary concerns and associated characteristics of children and adolescents with ASD who reported suicidal ideation.
Methods: Participants included 104 children and adolescents with ASD who presented to the ED of a major academic medical center. Participants were screened for suicidal risk through general questioning at triage and using the ASQ questionnaire. The ASQ is a 4-item suicide screening instrument that can be administered to patients in the ED for psychiatric or non-psychiatric reasons by nurses regardless of psychiatric training (Horowitz, et al., 2012). Participants who presented with psychiatric or behavioral complaints were screened more consistently than those with medical chief complaints. A chart review was conducted for 21 among 31 ASD youth who screened positive for suicidality with the ASQ screen (data for 10 participants were unavailable).
Results: Twelve children with ASD were identified as experiencing suicidal ideation on general screening at triage where as 31 children screened positive for suicide by the ASQ questionnaire, indicating that the ASQ picked up 19 additional cases of suicidality among this group. Among the 21 children with ASD and suicidal ideation according to the ASQ who were studied in detail, 12 (57%) reported previous attempts to hurt themselves. Nine (42%) were identified as a suicidal risk only by the ASQ questionnaire and were missed during general risk assessment at triage. Among them, six (33%) patients presented to the ED with a chief concern of aggression and 3(14%) presented with psychosis. The most common psychiatric diagnosis in youth with ASD were anxiety (n=11, 52%), ADHD/ODD (n=9, 42%) and mood disorders (n=8, 38%). Precipitants for suicidal ideation included limit setting, bullying, and conflicts at school or with peers.
Conclusions: Brief suicide screening instruments such as the ASQ appear to be effective in assess suicide risk in children and adolescent with ASD who present to the ED. Further research is needed to identify specific risk factors and clinical determinants that characterize suicidal behaviors in children and adolescents with ASD.

138 **126.138** Associations Between Dietary Composition and Gastrointestinal Symptoms in Autism Spectrum Disorder

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Background: Many individuals with autism spectrum disorder (ASD) have significant gastrointestinal (GI) symptoms, but the etiology is currently unknown. A previous study from our team found relationships between measures of autonomic nervous system (ANS) functioning and GI symptoms in ASD, especially for constipation. However, many individuals with ASD have altered diets which may affect GI functioning, and some may alter dietary composition in response to GI symptoms. Thus, it is important to examine dietary composition within the same sample of individuals from the aforementioned study to determine the possibility of diet interacting with the findings in this sample.
Objectives: In order to assess for an association between diet and GI functioning in ASD, we examined dietary composition and GI symptoms in a subset of individuals from a previous study in which our team had found relationships between measures of ANS functioning and GI symptoms, particularly for constipation.
Methods: A total of 80 individuals with ASD aged 6-18 who are enrolled in the Autism Speaks Autism Treatment Network (ATN) as well as general clinic patients at the University of Missouri Thompson Center for Autism and Neurodevelopmental Disorders participated in the study. A food frequency questionnaire assessing the child's dietary composition over the previous month was completed by the child's caregiver. The USDA Food Composition Database was utilized to provide comprehensive nutritional information for each food listed on the questionnaire, and the micronutrients and macronutrients contained in each food serving consumed over the past month were summed for each nutritional item (e.g., vitamins, minerals) for each participant. The child's upper and lower GI tract symptomatology over the past two months was assessed by administering the Questionnaire on Pediatric Gastrointestinal Symptoms, Rome III to this child's caregiver, and quantitative scores for upper and lower GI tract symptoms were created using a scoring rubric previously described by our research team.
Results: Although initial analysis found that upper GI tract symptoms were associated with total dietary fiber (p=0.042) and vitamin B6 intake (p=0.003), neither was statistically significantly associated with upper GI tract symptoms after adjusting for the 32 nutrients examined. There was no evidence for an association between lower GI tract symptoms and any nutrient.
Conclusions: These data suggest that nutritional composition is not associated with GI symptomatology in this sample of individuals with ASD. Therefore, variations in diet did not likely contribute to our previous findings of associations between GI symptomatology and ANS functioning as well as stress reactivity. Better understanding of other contributory factors will be needed to guide future research on the development of specialized treatments for those with ASD and co-occurring GI disorders.

139 **126.139** Associations of Sleep Disturbance and Autism Symptomatology in Children and Adolescents with ASD

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Background: Between 50 and 80% of children and adolescents with Autism Spectrum Disorders (ASD) present with sleep disturbances, compared to just 9-50% of neurotypical and developmentally delayed (without ASD) children, suggesting a fundamental disruption of the sleep system in ASD. Clinicians and researchers often disregard these sleep abnormalities, despite their potential impact on the primary symptoms of ASD and on caregivers. The relationship between sleep difficulties and behavioral habits is likely bidirectional, as lack of sleep fuels daytime irritability, and behavioral problems interfere with a consistent sleep schedule. The resolution of sleep issues may allow for improved outcomes for the core symptoms of ASD.
Objectives: This study aims to retrospectively assess the association of sleep disturbance in children with autistic symptomatology.
Methods: Subjects were children and adolescents (N=52) seen in the Yale Developmental Disabilities Clinic. Children aged 3-14 years, with a confirmed diagnosis of autism (ADOS CSS≥4) were included. After excluding children outside the age range or without a confirmed autism diagnosis and those taking sleep medications other than melatonin, the final sample included 21 children; data collection and retrospective analyses of additional historical cases are ongoing. Parents completed a sleep history questionnaire which characterized sleep/wake time and sleep onset latency (SOL) as well as a 40-item Autism Screener Questionnaire, assessing symptoms of autism. T-tests were performed to evaluate the relationship of sleep disturbance and autism symptoms.
Results: Â Children aged 3-14 years (N=21) with a diagnosis of autism were stratified into those with (N=16, 76%) and without (N=5) disordered sleep as defined by SOL≥30 minutes. Children with disordered sleep were significantly more likely to have unusual sensory fixations (p<.001).
Conclusions: Â In this pilot study of sleep disturbance in a pediatric population with autism, disordered sleep as defined by a sleep onset latency of ≥30 minutes was observed in the majority of children with autism. Results are consistent with previously noted high rates of disordered sleep in autism. Our findings also suggest that disordered sleep is strongly associated with autistic symptomatology, specifically unusual sensory fixations. Future studies should assess sensory issues as a risk factor for sleep disturbance.

140 **126.140** Autism, Anxiety and the Role of Gene Expression in Female Children and Adolescents with Fragile X Syndrome

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Background:
Fragile X syndrome (FXS) is a genetic disorder caused by a trinucleotide CGG expansion within the fragile X mental retardation 1 (*FMR1*) gene located on the X chromosome. In boys this typically leads to methylation and silencing of the gene. In girls, however, there is variability in gene expression due to compensation by the normally-functioning X chromosome. This variability provides an important opportunity to evaluate the differential role of FMR1 gene expression in the phenotypic presentation of the syndrome. FXS is highly comorbid (25-60%) with autism spectrum disorder (ASD) and with anxiety disorders (86%). Given the known increased prevalence of anxiety in females in general, the current study aims to not only elucidate the anxiety profile of adolescent females with FXS, but to also investigate the impact of ASD on anxiety in this population.
Objectives:
The current study evaluated the anxiety profiles of female children and adolescents with FXS, with and without comorbid ASD. Moreover, we included females with the full mutation and with mosaicism, as both groups allow us to explore the variable role of FMR1 gene expression on anxiety.
Methods:
Participants included 16 females with FXS, ages 9- 18, of which 8 had a comorbid ASD diagnosis. Allele status was confirmed by *FMR1* DNA testing. Activation ratio (AR) was calculated to measure the percentage of cells with the normal allele on the active X chromosome, and provided us with an estimate of *FMR1* of gene expression. Assessments included the Anxiety, Depression, and Mood Scale (ADAMS) used to evaluate anxiety, and the Autism Diagnostic Observation Schedule (ADOS) used to evaluate severity of autism symptomatology. An ANOVA was conducted to investigate the interaction between ADAMS, AR, and ASD diagnosis.
Results:
There was a significant main effect for autism diagnosis, F (1, 12) = 19.87, p = .001, such that girls with FXS who had an ASD diagnosis scored higher on the ADAMS (indicating increased severity) than those who did not. There was also a significant main effect for gene expression, F (1, 12) = 5.53, p = .037, and no diagnosis by gene expression interaction, indicating that individuals with decreased *FMR1* gene activation scored higher on the ADAMS independent of ASD diagnosis.
Conclusions:
These findings extend our knowledge about the role of autism and FMR1 gene expression in the severity of anxiety symptomatology present in adolescent girls with FXS. While prior work has focused on the prevalence of anxiety in the FXS phenotype, it has not, until now, examined the role of genetic variability in anxiety. Moreover, while ASD is also a clinically impactful component of the FXS phenotype, little to no work has linked ASD and anxiety directly to FXS. This study shows that not only do girls with FXS who have an ASD diagnosis have higher levels of anxiety, but that level of anxiety is directly impacted by the functioning of the *FMR1* gene.

141 **126.141** Behavioral Characteristics of Children with Comorbid Epilepsy and Autism Spectrum Disorder

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Background:
It is well recognized that epilepsy is more common among individuals with autism spectrum disorder (ASD) than in the general population, with prevalence estimates varying widely from 2.4 to 46 % compared to 1 to 2 % in the general population. While the co-occurrence of ASD and epilepsy is well established, it remains unclear if there is a causal relationship between the two disorders, or if shared neurobiological pathways are involved. The majority of research in to the relationship between comorbid epilepsy and ASD has focused on general variables including presence of intellectual disability and epilepsy type, yet little is known of the autism phenotype in this population, and how it differs from that of individuals with ASD alone. A few studies have investigated behavioral characteristics in those with ASD and epilepsy and have reported greater social impairment and maladaptive behaviors, yet results have been inconsistent and findings limited. Additional research is needed to fully characterize the autism-epilepsy phenotype as this may help to direct clinical care and assist in understanding the neurobiological basis of these co-existing disorders.
Objectives:
To compare clinical, genetic and neurobehavioral profiles of children with comorbid ASD and epilepsy to those with ASD alone in a clinic based, ethnically and racially diverse population.
Methods:
100 children with ASD (medical confirmation of diagnosis, completed DSM5 checklist or CARS-2 score verifying autism symptoms and ADOS-2 score in full autism range) were enrolled in the study (50 % Caucasian, 46 % racial or ethnic minority, 4% undisclosed). Eight subjects were diagnosed with epilepsy (history of two or more unprovoked seizures). Each subject underwent a detailed medical history and physical exam and chromosomal micro-array was sent. Participants were evaluated with the following assessments; Social Responsiveness Scale-2 (SRS-2), Vineland-II, PDDBI and either the Mullen Scales of Early Learning or the Stanford-Binet Intelligence Scales. Comparison was made between the ASD alone group (n=92) and those with comorbid ASD and epilepsy (n=8).
Results:
There was no significant difference in age, gender, race/ethnicity or presence of micro-array abnormality between groups. Children with ASD and epilepsy were reported to have higher rates of developmental regression, lower average IQ and were more likely to have speech delay. They were noted to have reduced responsiveness on the PDDBI along with decreased frequency of aggressive behaviors. In addition, the ASD/epilepsy group was noted to have greater deficits in social awareness on the SRS-2.
Conclusions:
We find that amongst children in a racially and ethnically diverse clinic setting, those with comorbid ASD and epilepsy have a greater degree of cognitive impairment and a specific pattern of behavioral deficits marked by reduced responsiveness and greater deficits in social awareness. Those with ASD and epilepsy have a decreased frequency of aggressive behaviors, possibly related to reduced awareness and responsiveness to their environment. These findings contribute to expanding literature describing the autism/ASD phenotype and the specific challenges faced by this subset of the ASD population.

142 **126.142** Behavioral Inhibition and Activation As a Modifier Process in Youth with ASD

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Background: The Modifier Model of ASD suggests that phenotypic variability in ASD may stem from non-syndrome specific psychological processes. One such process involves motivational biases, namely the Behavioral Inhibition System (BIS) and Behavioral Activation System (BAS). The BIS/BAS may not only contribute to core features of ASD, but these motivational systems have also been associated with vulnerability for emotional and behavioral difficulties in typically developing samples, which are also common co-occurring concerns among individuals with ASD. However, it remains unclear in what capacity BIS/BAS related motivation, as measured by a self-reported questionnaire, relates to ASD symptomology and co-occurring emotional and behavioral challenges in adolescents with ASD.
Objectives: This study aims to address the aforementioned gap in the literature by examining the relation between reports of behavioral inhibition and activtion, ASD Symptomology, and co-occurring emotional and behavioral symptoms in adolescents with ASD.
Methods: Forty-eight adolescents (Age: M=13.36, SD=1.37; IQ: 105.25, SD=18.21) with ASD participated in this study. One outlier was excluded from analyses. ASD was confirmed using the ADOS. Participants provided self-report on the BIS/BAS Scales and Youth Self-Report (YSR). Parents completed the Autism Spectrum Quotient (AQ) and the Child Behavior Checklist (CBCL) on their adolescent.
Results: Pearson's correlations revealed a significant negative association between the AQ total score and BAS Drive scale (r=-0.33, p=0.03). For the YSR, the BIS scale was positively related to the Anxious/Depressed (r= 0.45, p=0.001), Internalizing Problems (r=0.27, p=0.07), Anxiety Problems (r=0.40, p=0.005), Somatic Problems (r=0.31, p=0.03), Obsessive Compulsive Problems (r=0.38, p=0.008), and Post-Traumatic Stress Problems (r=0.45, p=0.002) subscales. The BAS Drive scale was positively related to the Withdrawn/Depressed YSR subscale (r=0.29, p=0.04). The BAS Fun-Seeking (r=0.36, p=0.02) and Reward Responding scales (r=0.37, p=0.01) were positively related to the Positive Qualities YSR subscale. For the CBCL, the BAS Fun-Seeking scale was negatively related to the Externalizing Problems (r=-.31, p=0.04), Withdrawn/Depressed (r=-0.29, p=0.05) and Somatic Problems (r=-0.30, p=0.04) subscales.
Conclusions: Overall, this study suggests that the BAS may be more salient for ASD-related symptoms, while the BIS appears to play a key role in co-occurring internalizing symptomology in adolescents with ASD. The BAS systems may modify the expression of ASD, such that less BAS Drive-related motivation was related to greater overall ASD symptom presentation. In regards to co-occurring symptoms, self-report on the YSR suggests that a greater tendency for BI may pose vulnerability for developing internalizing symptomology. The positive association between the BAS Drive and Withdrawn/Depressed might reflect that adolescents who have ASD and are more inclined to approach situations have more opportunities to experience social failure, which may trigger depressive symptoms. Parent-report revealed limited findings, potentially due the inherent imprecision of measuring internalizing symptomology as outside observers. Greater Fun-Seeking behavior was associated with a combination of less Withdrawn/Depressed and Externalizing problems. Perhaps, approach towards enjoyable experience (fun-seeking) is protective against displaying aggression and rule-breaking in youth with ASD.

143 **126.143** Behavioural Inhibition As a Predictor of Anxiety Problems Among Children at Risk for Autism Spectrum Disorders

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Background: Anxiety problems are highly prevalent among children and adolescents with autism spectrum disorder (ASD). However the constructs that lead to heightened levels of anxiety in ASD remain poorly understood. In typically developing children, behavioural inhibition (BI) in the early years, which refers to initial reactions of wariness, fearfulness and shyness in unfamiliar contexts, has been identified as a robust predictor of anxiety problems in later childhood. However, there has been no investigation of BI and its correlates with anxiety problems among children at risk for ASD.
Objectives: This prospective longitudinal study aims to explore whether elevated levels of anxiety are observed among infants at heightened familial risk of ASD (HR; due to having an older sibling with a diagnosis of ASD) compared to infants at low-risk (LR; having an older sibling without ASD). Parent-report measures of BI are obtained at 8, 14 and 24 months of age and used to investigate associations between BI and anxiety problems at 36 months.
Methods: The sample in this study includes 113 HR and 27 LR children. Of the 113 HR infants, 17 met DSM-5 criteria for ASD (HR-ASD), 32 participants did not meet clinical criteria for ASD but presented with other atypicalities (HR-Atypical), and 64 participants were typically-developing (HR-TD). BI was measured using the fearfulness subscale of the Infant Behaviour Questionnaire (IBQ) at 8 and 14 months and the fearfulness and shyness subscales of Early Childhood Behaviour Questionnaire (ECBQ) at 24 months. Anxiety problems were measured with the Child Behaviour Checklist (CBCL) at 36 months.
Results: There was a significant difference between outcome groups in anxiety scores F_w (3, 45) = 5.82, p<.001. Post-hoc comparisons showed that the HR-ASD group exhibited significantly higher anxiety scores than the LR group (d= 1.26, p= .001) and HR-TD group (d = 0.99, p= .001). There was a positive and significant association between BI scores at 8 (r=.30, p =.002), 14 (r=.35, p <.001) and, 24 (r=.48, p <.001) months and anxiety problems at 36 months. Conclusions: Children who met ASD diagnosis at age three years were reported to have elevated anxiety scores in infancy compared to LR and HR-TD groups. There was a significant association between BI and anxiety scores and the effect of this association increased from 8 months to 24 months. These findings are important for our understanding of BI as a predictor of the neurodevelopmental emergence of the co-occurring anxiety problems that are common in children with ASD.

144 **126.144** Characteristics of ASD in Adults with Williams Syndrome

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Background: Â Williams syndrome (WS), a rare developmental disorder caused by deletion at 7q11.23, is generally characterized by excessive socialization and communication (over-friendliness and talkativeness). While this over-socialization is sometimes thought to be antithetical to the stereotypical under-socialization of autism spectrum disorder (ASD), prior research has shown that many young children with WS also show significant symptoms of ASD and may meet diagnostic criteria for ASD based on observational and parent reports. Little work has been done on the social functioning and repetitive behaviors in adults with WS and little is known about the overlap of WS and ASD in an adult population.
Objectives: Â This study aims to explore the prevalence of ASD in adults with WS and understand the characteristics of those who meet criteria for both disorders
Methods: Data for this study are taken from an ongoing genetics, neuroimaging, and behavioral study of adults with William's syndrome. Preliminary information is based on the first eight participants. 20 participants are expected by April 2017. The Autism Diagnostic Rating Scale, second edition (ADOS) was conducted by a research reliable clinician. Participants also completed a wide range of behavioral, emotional, and cognitive measures, including the Social Responsiveness Scale (SRS; parent report), the Wechsler Adult Intelligence Scale, 3rd edition (WAIS), the Peabody Picture Vocabulary Test (PPVT) and the Expressive Vocabulary test (EVT).
Results: In this sample, two participants (25%) received an ADOS classification of Autism, and one (13%) received a classification of Autism Spectrum. Five participants received non-spectrum classifications. Participants who showed significant ASD symptoms on the ADOS also had significantly higher SRS Social Communication scores, but did not show different SRS Repetitive and Restrictive Behavior scores from the non-spectrum participants. Verbal IQ and receptive and expressive vocabulary scores had an inverse relationship with ADOS scores and were the best predictor of autism spectrum classification.
Conclusions: Despite differences in social presentation, many adults with Williams syndrome also show significant symptoms of ASD. These symptoms seem to be mainly focused in the social communication domain of ASD, and observational measures and parent report measures line up well. The level of repetitive behaviors and interests in adults with WS does not seem to adequately discriminate those with ASD and those classified as non-spectrum. As has been shown in previous research, verbal IQ and vocabulary scores seem to be a relatively good predictor of social communication deficits in this population. Overall, a significant portion of adults with Williams syndrome may be experiencing social communication dysfunction that reaches a clinically significant level and likely requires attention and intervention.

145 **126.145** Characteristics of Children with ASD Who Improve with Fever: Insights from the Simons Simplex Collection

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Background: Anecdotal evidence suggests that a subset of children with ASD may show improvements during episodes of fever. The only prospective study on this topic (Curran et al, 2007) found that 83% of children with ASD showed significant improvements on at least one domain of the Aberrant Behavior Checklist (ABC) during an episode of fever. Overall, little is known about the broader behavioral profiles of children with ASD who are reported to improve with fever.
Objectives: The purpose of this work is to explore the behavioral characteristics of children whose parents report improvements during episodes of fever.
Methods: Using data from the Simons Simplex Collection (SSC), parents of 2,152 children between the ages of 4 and 18 (mean=8.9, SD=3.6) provided information about whether and in what areas their child improved during fever. Children who were reported to improve during fever (n=362; Improve Group) and those who reportedly do not improve during fever (n=1690; No Improve Group) were randomly assigned into discovery or replication samples (See Figure 1). The discovery sample consisted of 850 children (50%) from the No Improve group and 183 children (51%) from the Improve Group while the replication sample consisted of 840 children (50%) from the No Improve Group and 179 children (49%) from the Improve Group. Improve and No Improve groups in the discovery sample were compared on 1) demographic variables (age, sex, race), 2) NVIQ, 3) language level (per ADOS module), 4) parent report measures of medical history, ASD symptoms, repetitive behavior, adaptive skills, 5) clinical observation of ASD symptoms, and 6) presence of an ASD-associated de novo genetic mutation. Results from the discovery analyses that met the statistical threshold of $\alpha < .05$ were compared in the replication sample to confirm results.
Results: 362 children (17%) were reported to improve during fever across a range of domains (Temper/Behavior: 59%, Communication: 49%, Social Interaction: 41%, Repetitive Behaviors: 38%, and Cognition/Learning: 21%). Discovery analyses revealed that children in the Improve Group had significantly lower NVIQ [$t(1031) = 3.70$, $p < .001$] and language level [$\chi^2(2, N = 1033) = 6.79$, $p = .03$], as well as more restricted, repetitive behaviors across several domains on the Repetitive Behavior Scale-Revised and ABC. These results were consistent during replication analyses. In discovery analyses, children in the Improve Group were statistically more likely to have breathing problems during sleep [$\chi^2(1, N = 1024) = 7.94$, $p< .01$], but this result was not significant in the replication sample. Groups did not differ in age, race, sex, current parent-reported symptoms of ASD or in the proportion of children with de novo mutations.
Conclusions: Parents of a subset of children with ASD report improvements during episodes of fever. These children have lower language skills, lower NVIQ, and more restricted, repetitive behaviors. Understanding the behavioral profiles of these children may provide insights into the etiology of ASD and lead to innovative treatments.

146 **126.146** Chronobiology in Adulthood Autism Spectrum Disorder

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Background:
Sleep disorders can occur in up to the 80% of people with Autism Spectrum Disorder (ASD). The evidence behind the contribution of sleep circadian rhythms and molecular mechanisms involving clock genes and melatonin route in ASD is very limited.
Objectives: Analyze the Circadian Rhythm sleep disorders (CRSD) in adults with ASD with Ambulatory Circadian Monitoring and their relationship with SNPs in *ASMT, Per1, Npas 2,* and *MTNR1A*genes.
Methods: A total of 92 subjects were enrolled on a prospective study to record sleep with Ambulatory Circadian Monitoring (24 hours for a week). Circadian rhythms (CR´s) were recorded and characterized by nonparametric indexes and sleep parameters were calculated. A subtotal of 51 subjects participated in a genetic substudy of SNPs from *ASMT, Per1, Npas 2,* and *MTNR1A*genes. Statistical analysis was performed using GraphPad Prism 5.0.
Results: ASD patients had significantly major total sleep time, sleep onset latency, num. awakenings, WASO and lower SE compared to controls with significant differences of Sleep CR´s along 24 h ACM determination. The genetic substudy found significant differences ($p< 0.05$) in the recessive genetic model from rs5989681 and overdominant genetic model of rs6416892 and rs885747 when compared the genotype and SOL.
Conclusions: This data suggest that ASD group sleep parameters and CR chronobiology could indicate the presence of CRSD in the ASD population. Apparently, there is a relationship between SOL and SNPs in genes Per1 and ASMT, but further genetic analysis increasing the study sample is required. Improving knowledge in this area is important for developing a model of sleep in ASD and targeting interventions.

147 **126.147** Chymotrypsin: Evidence of a Novel Pancreatic Insufficiency in Children with ASD?

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Background:
Emerging research has suggested that some children with ASD appear to be at high risk for gastrointestinal concerns. It has also been noted that many children with ASD have diets that are highly self- selective, e.g., having a preference for carbohydrates. Although it remains unclear what the basis for GI disruption is, it may be the case that some children with ASD have insufficient levels of digestive enzymes needed to process some food types, e.g., protein. If a child has this deficiency, they cannot optimally digest a class of food (e.g., protein), their food avoidance may be related to unpleasant sequelae associated with its ingestion (e.g., under-digested meat feeling like "lead shot" in the stomach). The enzyme chymotrypsin digests protein into its component amino acids. Amino acids, especially essential amino acids, play a crucial role in the production of neurotransmitters (e.g., dopamine and serotonin), are regulators of gene expression, and form the building blocks for new proteins.
Objectives:
The objectives of this study were: 1) determine the prevalence of abnormal levels of the enzyme fecal chymotrypsin (FCT) in children with autism, and 2) to determine whether FCTÂ levels are associated with severity of autistic symptomatology.
Methods:
Participants were 323 children between the ages of 3 and 8 years (261 boys; mean age: 5.8 yrs.) who met DSM-IV criteria for Autistic Disorder, as screened by the Social Communication Questionnaire (SCQ) and confirmed by Autism Diagnostic Interview-Revised (ADI-R) and clinical interview.Â FCT levels were assessed using photometric assay of stool samples (performed by Quest Diagnostics); FCT levels ≤ 12.6 U/g are considered abnormally/pathologically low. Severity of autistic symptomatology was assessed using the total score of the Social Communication Questionnaire (SCQ) and the ADI-R subscale scores.
Results:
Of the 323 children, 198 (61.3%) had abnormally low/pathological levels of FCT activity (<12.6 U/g; mean FCT level=7.34), while 38.7% had normal levels (>12.6 U/g; mean FCT level=18.92). Comparison of FCT level and autism symptom level (i.e., ADI-R subscale scores, SCQ total score) in all participants revealed no statistically significant associations between FCT level and severity of autistic symptoms. This finding suggests that lower FCT levels in children with autism are not associated with more severe autistic symptomatology.
Conclusions:
The presence of low FCT levels in a large subset of children with autism suggests that chymotrypsin deficiency may be a key feature in some children with ASD. This enzymatic deficiency may place these at higher risk for a suboptimal supply of amino acids, which may in turn possibly undermine their ability to produce neurotransmitters, regulate gene expression, and synthesize new proteins. These findings may inspire further research into the role of the pancreas and amino acid deficiency in autism, and in a broader sense, into the physiology and biochemistry of a subset of children with autism. It also provides rationale for investigating chymotrypsin replacement therapy in children with autism who exhibit FCT deficiency.

148 **126.148** Diagnostic Billing Codes Vs. MINI PAS-ADD Clinical Interview: Big Data Accuracy for Identifying Psychiatric Comorbidities in Adults with ASD

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Background: Researchers and clinicians report that 11-80% of individuals with ASD suffer from co-occurring psychiatric disorders. Researchers have begun taking advantage of the ease and availability of electronic medical records to study ASD and its comorbidities. Although this method of data collection is widely used to report prevalence estimates for medical conditions, the diagnostic accuracy of this data source for psychiatric conditions is unclear. Psychiatric conditions are more difficult to assess and could be biased by clinician preference, hospital setting, or documentation practices; therefore; it is possible that diagnostic billing code data are not a reliable source of case status identification. However, medical billing records still provide one of the only feasible opportunities to estimate co-occurring psychiatric disorders in large population-based samples.
Objectives: Evaluate the accuracy of using diagnostic billing codes to identify psychiatric comorbidities in adults with ASD.
Methods: Â This analysis is part of a larger study investigating medical, psychiatric, and social outcomes of 582 adults with ASD. The Mini PAS-ADD Clinical Interview was administered to assess co-occurring psychiatric disorders. The Utah Population Database provided diagnostic billing codes on psychiatric conditions from the two largest health care systems in the catchment area. All analyses were conducted between Mini PAS-ADD case status and diagnostic billing code case status for depression, expansive mood (bipolar disorder), anxiety, obsessive compulsive, psychosis, and an aggregated variable representing any co-occurring disorder. Chi-square tests were used to test for association. Spearman's rho was used to measure the strength of correlations. Lastly, sensitivity, specificity, positive predictive value, and negative predictive value estimates were calculated.
Results: Â The study sample consisted of 214 participants (84.6% male; mean age 35.4 years, SD=9.8) who had a completed Mini PAS-ADD interview. Fifty-four percent of participants had normal IQ. Significant differences were found in the proportion of ASD cases identified with co-occurring depression [$\chi^2(1)=22.5$, p <0.001], expansive mood [$\chi^2(1)=15.0$, p <0.001], obsessive compulsive [$\chi^2(1)=9.2$, p <0.005], psychosis [$\chi^2(1)=23.3$, p <.001], and any co-occurring disorder [$\chi^2(1)=4.0$, p <0.047] between the Mini PAS-ADD and diagnostic billing code approaches. In contrast, no difference was identified in the proportion of ASD cases with co-occurring anxiety [$\chi^2(1)=1.5$, p=0.22] between the two approaches.Â There were significant correlations for depression (r=0.32, p< 0.001), expansive mood (r=0.27, p<0.001), obsessive compulsive (r=0.21, p<0.002), psychosis (r=0.33, p<0.001), and any co-occurring disorder (r=0.14, p<0.05). Sensitivity estimates were relatively low, ranging from 24.1-58.2, and specificity estimates were relatively high, ranging from 67.9-92.7.
Conclusions: This preliminary analysis indicates that proportions of co-occurring disorders between data from diagnostic billing codes and diagnoses from the Mini PAS-ADD were discrepant. In addition, the sensitivity estimates were relatively low. Given that semi-structured clinical interviews are a preferred measure of co-occurring psychiatric conditions and the Mini-PAS ADD is empirically validated, the results suggest that diagnostic billing code data may not be a sensitive method of reporting co-occurring psychiatric diagnoses in adults with ASD for many co-occurring conditions. These associations will be explored further using an expanded data set.

149 **126.149** Differential Influences of ASD and ADHD Symptom Severity on Adaptive Functioning in Youth with and without ASD

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Background: Autism Spectrum Disorder (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD) are highly comorbid conditions, with population-based studies reporting that approximately 20% of children with ASD meet full criteria for an ADHD diagnosis (Surén et al., 2012). Children with comorbid ASD and ADHD tend to exhibit higher levels of autistic traits and lower levels of adaptive functioning than children with ASD alone, ADHD alone, or neither disorder. Only one study to date has investigated the ability of both ASD and ADHD symptom levels to predict adaptive functioning, finding that only ASD symptoms predicted adaptive behavior scores in a group of children with ASD, ADHD, or comorbid ASD/ADHD (Ashwood et al., 2015). It remains unknown whether that same relationship between dimensional trait measures and adaptive functioning exists in children with sub-clinical ASD/ADHD symptoms and higher levels of adaptive behavior.
Objectives: The current study aims to examine the relationship between dimensional measures of ASD and ADHD symptoms and adaptive functioning skills in youth with and without diagnosed ASD.
Methods: Parents of 45 (33 male, 12 female) intellectually able children and adolescents with ASD (age range 8-18, M = 14.13, SD = 2.62) completed the Child Behavior Checklist 6-18 (CBCL), Social Responsiveness Scale-Parent Report (SRS), and Vineland Adaptive Behavior Scales, Second Edition (VABS). These measures were also collected from the parents of 31 (17 male, 14 female) age- and IQ-matched typically developing (TD) controls (mean age = 14.13, SD = 2.24). The SRS total T-score served as a measure of autism symptoms, and the CBCL's Attention-Deficit Hyperactivity Problems (ADHP) T-score served as a measure of ADHD symptoms. Hierarchical regression analyses were performed separately for the two diagnostic groups, with the VABS subscales and Adaptive Behavior Composite (ABC) as dependent variables, Age, Sex, and FSIQ scores entered as independent variables during the first step (enter-method), and SRS and ADHP T-scores entered as independent variables during the second step of the analyses (stepwise-method).
Results: Regression analysis indicated that lower overall adaptive functioning (i.e. VABS ABC) was significantly predicted by higher SRS T-scores (β=-0.33) in the ASD group and higher ADHP T-scores (β=-0.41) in the TD group. Higher SRS T-scores significantly predicted reduced VABS Communication scores in both the ASD (β=-0.33) and TD (β=-0.49) groups. Like ABC scores, VABS Socialization scores were predicted by SRS T-scores (β=-0.42) in the ASD group and ADHP T-scores (β=-0.37) in the TD group. The regression model did not significantly predict VABS Daily Living Skills scores for either group (ASD: p=0.074; TD: p=0.194). The addition of ASD or ADHD symptom scores resulted in significant improvements in the predictive strength of all other models (ΔR^2=0.11–0.22, ps<0.05). In no model did both ASD and ADHD symptom levels independently predict adaptive behavior scores.
Conclusions: While ASD severity predicted overall adaptive functioning in those with ASD, sub-clinical ADHD symptoms more strongly predicted decreased adaptive functioning in children without either disorder. This finding implies that when present at sub-clinical levels, ADHD rather than ASD symptoms are more strongly related to functional impairment in the general population.

150 **126.150** Evaluation of Sleep Disruption in Adults with Neurodevelopmental Disorders

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Background: Comorbidities commonly reported in children with Autism Spectrum Disorder (ASD) include sleep problems and attention-deficit/hyperactivity disorder (ADHD). ADHD itself is also often associated with sleep problems, however, there is limited understanding of the interplay between ASD, ADHD and sleep, especially in adults.
Objectives: This study aimed to identify the extent of sleep disturbances in a clinic sample of adults with ASD, ADHD, and both ASD and ADHD; and their relationship to symptom ratings. In addition, it examined the potential influence of symptoms of depression and anxiety on sleep patterns, as these symptoms are especially common in adults with ASD, and can also disrupt sleep.
Methods: The Pittsburgh Sleep Quality Index (PSQI) and Insomnia Severity Index (ISI) were used to assess sleep patterns in 164 (111 male, 53 female) adult patients attending ASD and ADHD specialist diagnostic services at the Maudsley Hospital, London, UK. Of these, 30 had a clinical diagnosis of ASD alone (ICD10), 98 had a clinical diagnosis of ADHD alone (DSM-V), and 34 had a dual clinical diagnosis of ASD and ADHD. Self-reported symptoms of ASD, ADHD, depression and anxiety were rated using the Autism-spectrum Quotient (AQ), Barkley's scale, and the Hospital Anxiety and Depression Scale (HADS), respectively.
Results: Overall, 91% of participants had "poor" sleep on the PSQI (total score 5+) and 44% had either "moderate" or "severe" insomnia on the ISI (score 15+). These high rates did not differ across the diagnostic groups (group comparison t-tests, all p>0.23). Insomnia scores across the entire cohort correlated with the HADS Anxiety score (r=0.477, p=0.001) but not the Depression rating (p=0.15). Insomnia scores also correlated with symptoms of hyperactivity (r=0.380, p=0.001), but not inattentive symptoms (p=0.15) and not with self-reported ASD symptoms (r=0.180, p=0.130). PSQI total score correlates were similar. Anxiety scores tended to be higher in those with ASD (p=0.055); whereas Barkley hyperactivity scores were significantly higher in those with ADHD (p=0.009).
Conclusions: This preliminary study indicates a high burden of sleep disturbances in adults with ASD, ADHD and comorbid ASD with ADHD. However the origins of these symptoms may be different in each condition, and this could have important implications for management. For example, it appears possible that anxiety is relatively more important in driving sleep problems in ASD, while hyperactivity is relatively more important in those with ADHD. Further work to characterize the causes of, and possible interventions for, sleep disorders in adults with neurodevelopmental conditions is therefore underway.

151 **126.151** Exploring Relationships Between Cognitive Rigidity, Alexithymia, Emotion Regulation, Intolerance of Uncertainty and Anxiety in Autism Spectrum Disorder

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Background: The increased prevalence of anxiety and autism spectrum disorder is now well documented (eg Simonoff et al 2008) and understanding of the atypical presentation of anxiety is also much advanced (Kerns et al 2014). However the aetiology of increased rates and atypical presentations is less well understood. Promising avenues of investigation include neurocognitive mechanisms such as cognitive rigidity and intolerance of uncertainty, and emotion processing pathways such as alexithymia and emotion regulation.
Objectives: In this study we investigate the inter-relationship between these variables and the relative impact of each on anxiety in a dataset of children diagnosed with autism spectrum disorder, using the ADI and ADOS, across a range of intellectual disability.
Methods: Questionnaires measuring intolerance of uncertainty, cognitive flexibility and alexithymia were administered to parent and child dyads as well as an emotional regulation questionnaire to parents only. Univariate statistics will be used to investigate significance of proposed predictors for anxiety. For the binary logistic regression, a model for anxiety will be developed using a backward elimination approach and then the performance of the proposed model will be assessed.
Results: Full results will be presented at IMFAR as we are currently still in the process of collecting data. The dataset will consist of approximately 150 children and parent dyads, with children aged between 6-18, and a gender ratio of approximately 3:1 males to females.
Conclusions: We propose a comprehensive model for mechanisms underpinning and/or leading to the increased prevalence of and frequently atypical presentation of anxiety and autism spectrum disorder.

152 **126.152** Exploring the Applicability of Models Explaining Development of Suicidal Thoughts and Behaviours in the General Population to the Case of Autism: A Systematic Review

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Background: Recent theoretical frameworks have been developed to explain why those who experience suicidal ideation may or may not go on to attempt suicide in the general population. However, despite growing evidence that suicidality is more prevalent in adults with Autism Spectrum Conditions (ASC) compared to the general population, these theoretical models have not been considered in relation to ASC.
Objectives: This systematic review aimed to identify models conceptualising the movement from suicidal thoughts to suicidal behaviours within the general population and consider their potential application to our understanding of suicide in ASC.
Methods: A systematic search of online databases (Psycinfo, PsycArticles, MEDline, EbscoAcademic Complete, CINAHL and Web of Science) was carried out to identify articles relating to models explaining the movement from suicidal thoughts to behaviours, in the general and ASC populations. In the general population, 385 articles were considered against the search strategy criteria and 7 studies were included in the final qualitative synthesis. The search was repeated to include ASC search terms and no relevant articles were returned.
Results: Three relevant models were identified through the general population search; the Interpersonal-psychological theory, the Integrated Motivational-Volitional model and the Three-Step theory. Characteristics of ASC were found to overlap with risk factors for both suicidal thoughts and behaviours in the general population. Reported difficulties in ASC including social cognition, and memory biases were represented as factors contributing to suicidal ideation in the general population, particularly within the integrated motivational-volitional model. All three models implicated some ASC symptoms including impulsivity and sensory sensitivities, as conferring increased capability for progressing from suicidal ideation to suicidal behaviours.
Conclusions: Although the search uncovered no current models of suicidality in people with ASC, findings from general population models generate hypotheses for future research to systematically explore suicidality within ASC populations. The general population models also provide an initial basis for developing ASC specific frameworks which take account of increased risk due to ASC symptomology. Findings of the systematic review and qualitative evidence synthesis provide a useful framework for future research exploring suicidality in ASC.

153 **126.153** Exploring the Relationship Between Autism Symptoms, Language Ability, and Externalizing Behaviors in Children with Autism

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Background:
Individuals with autism spectrum disorders (ASD) often possess ADHD symptoms and problematic externalizing behaviors, which can exacerbate autism symptoms and reduce adaptive functioning skills (Sikora, Vora, Coury & Rosenberg, 2012). However, the relationship between these ADHD symptoms/externalizing behaviors and autism in children with minimal language has yet to be established.
Objectives:
The present study aimed to (1) evaluate the differences in presentation of externalizing behaviors between individuals with fewer than 5 words compared to those with more than 5 words and (2) to determine the relationship between autism characteristics and externalizing behaviors controlling for demographic characteristics.
Methods:
The present study included cross-sectional participant data from the Simons Simplex Collection and the National Database of Autism Research. Individuals who had received an ADOS Module 1 assessment were included in the presented analyses (Lord et al., 2012). Those who were rated as having fewer than 5 words on the ADOS item *Overall Level of Non-Echoed Spoken Language* were included in the “no words” group (*N*= 354) and individuals with more than 5 words were included in the “some words” group *(N*= 538). Externalizing behaviors were measured using the Child Behavior Checklist (CBCL) 1.5-5 or 6-18 *Aggressive Behavior* and *Attention Problems* and the Aberrant Behavior Checklist (ABC) *Hyperactivity* and *Irritability* subscales. First, magnitudes of mean differences between language groups on externalizing behaviors were computed using t-tests. Second, ADOS subdomains, gender, age, and language level ("no words", "some words"), were evaluated as predictors of externalizing behaviors in four separate regression models and insignificant predictors were excluded in the presented analyses. A Bonferroni correction (p<.0125) was applied to correct for multiple comparisons.
Results:
Language level did not significantly predict externalizing behaviors (*Attention Problems*: β=0.10, p=.99, *Aggressive Behavior*: β=0.33, p=.80, *Hyperactivity*: β=0.31, p=.09, *Irritability*: β=0.43, p=.17). None of the included variables were significant predictors of *Aggressive Behavior* $F(12,452)=1.51$, p=.12. ADOS RRB uniquely predicted both *Attention Problems* $F(1,466)=12.71$, p<.01 and *Irritability* $F(1,504)=7.92$, p<.01 such that more severe RRBs were associated with greater attention problems (β=0.16) and irritability (β=0.12). In contrast, *Hyperactivity* was predicted by ADOS SA Â (p<.01) and age ($F(2,695)=18.77$, (p <.01), such that more severe social affect was associated with higher levels of hyperactivity (β=0.14), and increasing age was associated with fewer symptoms of hyperactivity (β=-0.18).
Conclusions:
While presence of externalizing behaviors do not differ significantly for autistic individuals with no words compared to some language, externalizing behavior domains show varying association with social affect and RRBs. Individuals with more impaired social affect display more symptoms of hyperactivity, suggesting that treatment of hyperactivity symptoms may improve level of social engagement. It is noteworthy that the severity of RRBs is only associated with higher irritability and more attention problems. Determining the nature and directionality of the relationship between RRBs and attention and irritability is an important question for future research as well as exploration of additional predictors of externalizing behavior in minimally verbal individuals with autism to potentially facilitate intervention for core deficits.

154 **126.154** Exploring the Validity of the Social Anxiety Scale in Capturing Symptoms of Social Anxiety in Youths with Autism Spectrum Disorder

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Background: Previous research indicates a high clinical prevalence of co-morbid anxiety in individuals with autism spectrum disorder (ASD). However, there has been less focus on the specific co-occurrence of social anxiety (SA) in ASD (Gillott et al., 2001). Limited research examines different aspects of SA or the relationship of SA to perceived social responsiveness in individuals with ASD (Bellini, 2004). Furthermore, while the Multidimensional Anxiety Scale for Children (MASC) has been found to be an appropriate measure of anxiety in ASD, there is a need for additional valid measures of SA specifically.
Objectives: The current study investigated SA in children with ASD and typically developing (TD) controls. We sought to evaluate the convergent validity of the Social Anxiety Scale for Adolescents/ Children, Revised (SAS-A/SASC-R) in capturing symptoms of SA in individuals with ASD through comparison to another established measure, the MASC. We also aimed to measure child-parent agreement in reports of the child's SA, as well as the relationship between SA and social behavior in ASD.
Methods: This study's sample was composed of 50 youth with ASD (37 males, 13 females) and 25 TD youth controls (18 males, 7 females), matched on gender, age and IQ (Table 1.). Data collection is ongoing. Social anxiety was measured using multiple standardized measures. Child self-report measures included the Multidimensional Anxiety Scale for Children (MASC-C) and Social Anxiety Scale for Adolescence/Children (SAS-A/SASC-R). Parent report of SA was also assessed by the MASC (MASC-P) and the child's social behavior was reported on the Social Responsiveness Scale, Parent Report (SRS-P).
Results: Children with ASD reported higher symptoms of SA [*M*=44.62, *SD*=11.76] than those with TD [*M*=38.44, *SD*=12.36] on the SAS-A/SASC-R [*F* (1,73) = 4.45 *p*=.04]. A multitude of significant correlates were found (Table 2.). SAS-A/SASC-R Total scores were highly correlated with the MASC-C SA [*r* =.70, *p*<.001] and MASC-P SA [*r*=.43, *p*<.001]. The subdomains of the SAS-A/SASC-R, Fear of Negative Evaluations (FNE) and Social Avoidance and Distress in New Situations and with New Peers (SAD-N) were also significantly correlated with the subdomains of the MASC-C, Humiliation and Rejection [*r*=.71, *p*<.001] and MASC-C Performance Fears [*r*=.59, *p*<.001], respectively. Child and parent scores on the MASC SA domain were significantly correlated (*r*=.39, *p*<.0.01), as were the MASC-P SA score and the child's SAS/SASC-R total [*r*=.44, *p*<.001]. The SAS-A/SASC-R, the MASC-C, and MASC-P SA domain did not correlate significantly with any domains of the SRS-P.
Conclusions: This study examined the validity of the SAS-A/SASC-R to measure symptoms of SA in individuals with ASD in comparison to the previously established use of the MASC. Results confirmed that the SAS-A/SASC-R can be used to measure symptoms of SA in ASD and can provide insight into the specific factors of SA that may be affecting the child. In this sample, social ability and symptoms of SA did not correlate. The SAS-A/SASC-R is likely capturing true symptoms of SA in children with ASD that are distinct from difficulties in social behavior as captured by the SRS-P.

155 **126.155** Eye Gaze Patterns of Adolescents with Social Anxiety Disorder: Associations Between ASD Features and Fixation Duration to Affective Stimuli

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Background: Social Anxiety Disorder (SAD) is characterized by fears of potential evaluation by others. Autism Spectrum Disorder (ASD) is characterized by social communication impairments and restricted interests and repetitive behaviors (RRBs). SAD is a common co-occurring disorder for adolescents with ASD (White et al., 2014), however there is little agreement on how to disentangle features of SAD from ASD impairments. Although extant research has examined features of SAD within individuals with ASD (White et al., 2015), no research to date has examined how the features of ASD might manifest within youth with SAD. Previous eye-tracking research has shown that anxiety is associated with vigilance to angry faces (Mogg et al., 2000). However, the association between ASD features and fixation duration in teens with SAD has not been examined. It was predicted that features of ASD would be associated with heightened fixation duration to angry faces.
Objectives: The objective is to explore the influence of ASD features (i.e., social communication deficits, RRBs, and overall severity) on gaze in teens with SAD.
Methods: Data were drawn from a randomized controlled trial of a computerized treatment to reduce social anxiety in youth with SAD. The eye-tracking task used the NIMH Child Emotional Faces Picture Set (NIMH-ChEFS; Egger et al., 2011) consisting of teen faces. Each stimulus presentation contained a pair of photographs of the same person, one photo depicting an emotional expression and the other depicting a neutral emotional expression. All participants (*n*=49; *M*age=14.35) were between the ages of 12-16 and free of a co-occurring intellectual disability. SAD diagnoses were confirmed by semi-structured clinical interview (ADIS; Silverman & Albano, 1996) and youth with prior ASD diagnosis were excluded. Parents completed the Social Responsiveness Scale-2 (SRS-2; Constantino, 2012) as an index of ASD symptom severity and the youth self-reported on social anxiety via the Screen for Child Anxiety Related Disorders (SCARED; Birmaher et al., 1997).
Results: For the present analyses, social anxiety severity was controlled for in order to uniquely examine the role of ASD features on gaze duration to emotional faces. Partial correlation coefficients indicated that greater parent-reported ASD symptom severity was associated with longer gaze duration to happy faces (*r* = .34, *p* = .038). Contrary to our hypotheses, no significant association was present between ASD symptom impairments and gaze duration to angry faces. In addition, social communication difficulties (per the SRS-2 SC subscale) were also associated with longer gaze duration to happy faces (*r*=.44, *p*=.006). No significant association was found between RRBs and fixation duration, however.
Conclusions: The findings highlight that elevated ASD impairments are associated with greater fixation duration to happy faces, even after controlling for SAD severity. Socially anxious teens with heightened ASD severity and social communication difficulties might experience difficulties in peer relationships. Therefore, they might avoid looking at angry faces which could signal peer rejection. In turn, happy faces might serve as a security signal or protective factor from peer rejection. Findings highlight the importance of considering ASD features when conducting eye-tracking research with adolescents with SAD.

156 **126.156** Facing Puberty: Understanding the Onset and Experience of Menses for Females with Autism Spectrum Disorder

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Background: Living with an Autism Spectrum Disorder (ASD) presents challenges across the lifespan. Puberty may pose unique difficulties for females with ASD with the onset of menses. Only a handful of studies have addressed onset and presentation of menses in females with ASD, yet the experience of puberty for these young women is currently absent from the literature. Findings suggest menarche may be incongruent to Neurotypical (NT) peers and menstrual symptoms may be more severe (Knickmeyer et al., 2006; Ingudomnukul et al., 2007, Burke et al., 2010, Whitehouse et al., 2011, Hamilton, Marshall & Murray, 2011, Pohl et al., 2014, Hergüner & Hergüner, 2016). As age at menarche (AAM) is associated with increased risk of serious health concerns across the lifespan, including obesity, adolescent depression and social anxiety (Freedman et al., 2003; Joinson et al., 2011; Blumenthal et al., 2009), these findings recommend further exploration into the timing and experience of puberty in females with ASD.
Objectives: (1) Describe the onset and symptoms of menses for females with ASD compared to NT, controlling for factors associated with menses, (2) compare reporting of menses between daughters and parents, and (3) explore the experience of puberty for females with ASD and their families.
Methods: Â Mixed-method study combining self- and parent-report on web-based questionnaires with semi-structured interviews of parent-daughter dyads. Participants were females under 18 years with (ASD Group) and without (NT Group) a diagnosis of ASD who had at least one menstrual cycle in the previous six months, and one parent.
Results: A multiple regression model was significant ($F(11, 54) = 2.19$, $p = 0.03$), with diagnoses of ASD in the daughter or a sibling representing significant predictors for early AAM ($\beta = -0.38$, $p > 0.01$; $\beta = -0.39$, $p > 0.01$). Parents of both ASD and NT participants reported similar AAM as their daughters. No differences were observed in characteristics of the menstrual cycle or symptoms across groups. Neurotypical parents underreported the severity and occurrence of their daughter's menstrual symptoms across all reported areas. ASD parents underreported level of menstrual pain, physical and behavioral symptoms, while reporting more pre-menstrual, emotional and dysmenorrhea symptoms. Participants discussed several themes, including (1) preparation for puberty, (2) the physical experience of menses, (3) speed bumps on the road through puberty, (4) managing the everyday, (5) looking to the future, and (6) reflective advice.
Conclusions: Controlling for known covariates, we observed a significant decrease in AAM for those reporting a diagnosis of ASD in the daughter or a sibling, suggesting the possibility of an underlying developmental mechanism common to both ASD and AAM. The participants underscored the unique and varied experiences of puberty for females with ASD, which highlights the importance of qualitative research for a holistic understanding of adolescence in females with ASD. These findings raise concerns for the health of women with ASD across the lifespan. It is critical that practitioners serving this population appropriately screen for associated health outcomes, as well as work towards establishing evidence-based education and resources for these families.

157 **126.157** Food Selectivity and Nutritional Deficits in Children with Autism Spectrum Disorder: Electronic Medical Record Review

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Background: Children with Autism Spectrum Disorder (ASD) may exhibit a range of behavioral problems, including aggression, disruptive behavior, abnormal sleep patterns, toileting issues, and feeding problems. Food selectivity by type (i.e., eating only a narrow variety of foods) is a well-documented feeding concern in ASD, often involving strong preferences for starches and snack foods coinciding with a bias against fruits and vegetables. Children with food selectivity by type are at increased risk of nutritional deficiencies. Food selectivity by type falls under the diagnosis of Avoidant/Restrictive Food Intake Disorder (ARFID; APA, 2013), which requires failure to meet nutrition and/or energy needs. To date, however, research on food selectivity by type and associated health consequences is limited.
Objectives: This study describes food selectivity by type and nutritional deficiency in sample of patients with ASD referred for an interdisciplinary evaluation to the Pediatric Feeding Disorders Program at the Marcus Autism Center.
Methods: Electronic medical records of all patients referred for an interdisciplinary evaluation between January 2015 and January 2016 were reviewed. The electronic medical record review included: sex, age, diagnosis, chief complaint, anthropometric parameters, disruptive behaviors during meal time, and dietary status.
Results: A total of 163 children (age range 2.78 to 17.55 years) were referred for evaluation. Of these, 54 (33.1%) patients had a diagnosis of ASD and food selectivity by type and, thus, met inclusion criteria. All children exhibited disruptive behaviors during mealtime. 9.3% of children were underweight; 24.1% were overweight or obese. Detailed data on dietary intake were available for 33 patients; 24 of these children were deficient in 5 or more nutrients. Poor dietary intake of the following micronutrients was observed: vitamin A, vitamin B12, vitamin C, vitamin D, vitamin E, folic acid, calcium, iron, and zinc (Table 1).
Conclusions: These results suggest that in children with ASD and food selectivity by type are not consuming a diet adequate in vitamins and minerals. Children with ASD and food selectivity by type may require nutritional monitoring to prevent nutritional deficiencies. Further examination of the nutritional deficiencies in ASD associated with food selectivity by type, and associated health consequences, could contribute to the development of nutritional guidelines for clinicians and parents facing the challenges of food selectivity by type in children with ASD.

158 **126.158** Gastrointestinal Symptoms in Chinese Children with Autism Spectrum Disorder: Association with Emotional Symptoms?

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Background:
Autism spectrum disorder (ASD) is a complex neuro-developmental disorder with a wide range of physical and psychiatric co-morbidities. Identification of subgroups, e.g., in terms of comorbidities, has the potential to help clarify and disentangle the heterogenous aetiologies of the disorder. The comorbidity of gastrointestinal (GI) symptoms in a proportion of children with ASD has been put forward as a subgroup marker, and complex gut-brain interaction is thought to contribute to pathogenesis in this subgroup.
Objectives:
This study evaluated whether Chinese children with ASD did have an elevated rate of GI symptoms. Its design improved on previous studies by controlling a wide range of potential confounds which might in fact be the agents contributing to the increased rate of GI symptoms such as co-morbid emotional problems. The latter by themselves were well known to be associated with GI symptoms. Those previous studies could not be conclusive when failing to control such confounds.
Methods:
This study compared the rates of GI symptoms between Chinese children with ASD and typically developing community controls using the Questionnaire on Pediatric Gastrointestinal Symptoms – Rome III Version (QPGS-III). Confounding variables examined included the children's age, gender, co-morbid psychopathologies, diets, and parental anxiety and depression.
Results:
Our results were similar to western findings in that Chinese children with ASD were twice as likely to suffer from GI symptoms compared to typically developing children in the community. The types of increased GI symptoms most commonly reported were constipation, abdominal migraine and aerophagia. Of all the potential confounds examined, comorbid emotional problems exhibited a main effect in predicting increased GI symptoms, in addition to a main effect of ASD diagnosis in the regression analysis. More intriguingly, there was also an interaction effect between ASD and emotional symptoms to predict GI symptoms. In other words, while the presence of emotional symptoms was associated with an increased rate of GI symptoms in both the ASD and the community groups, the increase was significantly greater for children with ASD than for children without.
Conclusions:
Our findings indicate that ASD, emotional problems and GI symptoms form a multiplicative relationship. Despite that ASD and emotional problems are known to each contribute to an increased rate of GI symptoms, a multiplicative relationship is a new finding not reported previously. Such relationship warrants further investigation as a marker of an ASD subtype with potential distinctiveness in terms of etiologies, course of development, prognosis and treatment, etc.

159 **126.159** Gastrointestinal Symptoms, Behavioural Problems and Restricted Repetitive Behaviours in an Italian Sample of ASD Preschoolers

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Background: Gastrointestinal (GI) symptoms in patients with ASD aged 1–18 years have been reported with prevalence higher than in typical development population, ranging from 9% to 91%, depending on the study's characteristics. Moreover, a greater severity of problem behaviours as irritability, emotional dysregulation, anxiety and affective disorders was found in children with ASD and concurrent GI symptoms. In addition, in children with ASD a correlation between GI symptoms and rigid/compulsive behaviours, increased sensory sensitivity, and sleep problems has been suggested. It is worth noting that behaviour problems, and possible self-damaging acts could increase in ASD patients who are not able to communicate their GI discomfort.
Objectives: This study aims to explore if and how the presence of GI symptoms could influence the clinical features of ASD preschoolers and whether it is possible to define a particular clinical phenotype characterized by the presence of GI symptoms and ASD.
Methods: A total of 163 preschoolers with ASD were included in the study, comprising 137 males and 26 females (mean [SD] age = 43.16 [13.85] months; range 20-71 months). ASD patients were assessed through the ADOS, psychometric test, language assessment, Child Behavior Checklist (CBCL 1½-5), and Repetitive Behavior Scale-Revised. CBCL 1½-5 has been used to explore GI symptoms and to identify two groups on the basis of the presence or absence of GI symptoms ("ASD GI+" versus "ASD GI−").
Results: The percentage of ASD GI+ patients was 40.5%; the more frequently reported symptoms were constipation, feeding problems and abdominal pain. Greater severity of behavioural problems in ASD GI+ children compared to ASD GI- peers was found, whereas differences in ADOS calibrated severity mean scores, in language level and in performance IQ between the two groups were not significant. In ASD GI+ versus ASD GI- patients were detected: (a) more frequent and severe stereotyped behaviours and restricted interests; (b) a more severe dysregulation profile (sum of the scores of the "Anxious/Depressed", the "Attention Problems" and the "Aggressive Problems" scales of the CBCL); (c) significant higher scores in "Externalized Problems" and "Total Problems" scales of the CBCL (and in lesser proportion also in "Internalized Problems" scale). Moreover, more self-injurious behaviours were observed in subjects with constipation.
Conclusions: We confirm a high prevalence of GI problems in ASD pre-schoolers; in particular, the most common types of GI symptoms in children with ASD were constipation, abdominal pain and significant food problems expressed as resistance to feeding. More frequent behavioural problems were observed in ASD individuals GI+ that could be interpreted as manifestations of a distress difficult to communicate. Crucially, ASD GI+ individuals were not different in language level, cognitive development and autism severity than ASD GI- children. It is therefore useful to investigate the possible presence of GI symptoms in all patients with ASD, even more in children with repetitive and behavioural problems.

160 **126.160** Hedonic Capacity Influences Motivated Behavior in Autism Spectrum Disorder

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Background: Major depression (Treadway, Bossaller, Shelton, & Zald, 2012) and anhedonia (Treadway, Buckholtz, Schwartzman, Lambert, & Zald, 2009) influence effort expenditure for rewards and major depression is one of the most common comorbid psychiatric disorder in autism spectrum disorder (ASD) (Ghaziuddin, Ghaziuddin, & Greden, 2002).
Objectives: Our research group recently reported different profiles of effort expenditure for rewards in adolescents with ASD (Mosner, Kinard, Mcweeny, Shah, Damiano, Burchinal…& Dichter, 2016). Specifically, adolescents with ASD were characterized by decreased motivated behavior in response to medium and small reward magnitudes and high reward probabilities on the Effort-Expenditure for Rewards Task (EEfRT).Â The goal of the current study was to explore whether depressive symptoms or hedonic capacity were related to patterns of motivated behavior in adolescents with ASD in this same sample.
Methods: Twenty-six typically developing controls (TDCs; age *M*= 15.81, *SD*=3.06; IQ *M*= 109, *SD*=10.82) and 49 high-functioning adolescents with ASD (age *M*=15.98, *SD*=2.59; IQ *M*=103, *SD*=17.00) completed the EEfRT. On each trial, participants choose between selecting an "easy task" for the chance to win a small, constant monetary reward, or a "hard task" for the chance to win a variable, but consistently larger monetary reward. Each choice was presented with a low, medium, or high probability of winning the reward if the task was successfully completed (Treadway, Buckholtz, Schwartzman, Lambert, & Zald, 2009). Depressive symptoms were measured using the Child Depression Inventory (CDI; ages 12-17; Helsel & Matson, 1984) and the Beck Depression Inventory (BDI; ages 18-20; Beck, Steer, Ball, & Ranieri, 1996).Â Because younger participants received the CDI and older participants received the BDI, CDI and BDI scores were standardized within groups and then combined to create a continuous measure of depressive symptoms examined across all participants. Hedonic capacity was measured using the anticipatory and consummatory subscales of the Temporal Experience of Pleasure Scale (TEPS; Gard, Gard, Kring, & John, 2006).
Results: Correlations between the CDI /BDI composite score and the anticipatory subscale of the TEPS and all EEfRT metrics were non-significant. There were significant correlations between the consummatory subscale of the TEPS and EEfRT choices on the high reward probability (r=0.37, p<0.05), medium reward magnitude (r=0.31, p<0.05), and low reward magnitude (r=0.34, p<0.05) conditions. These correlations remained significant when controlling for severity of ASD symptoms as measured by the Social Responsiveness Scale (SRS; Constantino et al., 2003).
Conclusions: These results extend prior findings on relations between hedonic capacity and effort expenditure for rewards in a nonclinical sample (Geaney, Treadway, & Smillie, 2015) to an ASD sample, although the prior nonclinical finding identified linkages with anticipatory pleasure (Geaney, Treadway, & Smillie, 2015) and the current ASD study found linkages with consummatory pleasure. These results suggest hedonic capacity is related to motivated behaviors in adolescents with ASD and that future studies addressing reward processing in ASD should consider hedonic capacity as an important explanatory variable.

161 **126.161** IMPACT of Multiple Comorbid Emotional and Behavioral Conditions on Youth with Autism and Their Families

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Background:
Comorbid emotional and behavioral problems are very common in children and adults with autism (Levy et al., 2010), and several studies have highlighted the effects of comorbid conditions on school performance, adaptive skills, and peer relationships (Storch et al., 2012). These additional complications also place strain on the entire family as well as the individual with autism (Kerns et al., 2015). The literature in this area includes a wide variety of methods and assessment tools and sample characteristics. Prior research has been limited by narrow samples, limited outcome constructs, and a lack of attention toward child- or family-level variables that may influence the impact of comorbid conditions.
Objectives:
The purpose of this project was to determine whether comorbid emotional and behavioral problems significantly impact children with autism over and above child and family characteristics. Our primary hypothesis was that emotional and behavioral comorbidities in youth with autism would be associated with greater functional impact for the child, more difficulty accessing services, greater family impact, and greater transitional needs.
Methods:
Using the 2009-2010 National Survey of Children with Special Health Care Needs (NSCSHCD), we examined 3,055 cases of children and adolescents with autism (ages 2 to 17) who had varying numbers of comorbid conditions (i.e., ADHD, depression, anxiety, or behavior problems). For continuous dependent variables, hierarchical linear regressions were executed, with child-level variables entered in the first block (age, intellectual disability, and developmental delay), family-level variables entered in the second block (income, education, and respondent relationship), and number of comorbidities entered in the third block. For dichotomous dependent variables, the same three block method was used in hierarchical logistic regression analyses. We reported effects sizes for significant predictors with an odds ratio greater than 1.
Results:
Multiple comorbid conditions did have a significant impact on elements of child functioning (i.e., daily activities and school attendance), difficulties and frustrations accessing services for multiple reasons, and family impact (mental health need, more hours of care) in youth with autism. These effects were observed over and above the effects of child age, intellectual disability, developmental delay, family income, family education, and respondent relationship. Child and family characteristics were also important predictors for outcomes in child functioning, family impact, and transitional needs.
Conclusions:
These findings are important for families, practitioners, paraprofessionals, and educators of youth with autism. Addressing the compounding effects of comorbid emotional and behavioral conditions may improve services and supports for youth with autism and their families.
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162 **126.162** Implementing Reliable Screening of Co-Occurring Medical Conditions in Children with Autism Spectrum Disorders Across the Autism Treatment Network

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Background: Children with an Autism Spectrum Disorder (ASD) frequently present with co-occurring medical conditions such as sleep problems and constipation. These disorders, when left untreated, may compromise not only general health, but also behavioral, developmental, and educational outcomes of individuals with ASD. Clinical care recommendations exist for sleep problems and constipation in ASD, but these guidelines are underutilized. Screening for these conditions by clinicians is inconsistent, resulting in delays in, or lack of treatment. Children with ASD require regular screening for chronic co-morbid health conditions during the course of regular health supervision visits.
Objectives: Our primary goals were to a) increase reliable screening for these medical co-occurring conditions in children with ASD by subspecialists, b) for patients with a positive screen, develop appropriate care plan(s) in partnership with families to address the problem(s).
Methods: This effort used quality improvement (QI) methodology to promote reliable screening for sleep problems and constipation in a network of 15 medical centers. The Model for Improvement, developed by Associates in Process Improvement (API), was used to frame the work. Specific Measureable Actionable Realistic Time (SMART) aims were developed focusing on increasing screening, and documentation of constipation and sleep problems. Interventions were tested to improve the reliability of screenings and development and documentation of care plans. These included education sessions for providers and clinic staff, modifications to medical records procedures, and personalized interventions for low performing providers. The sites randomly selected 20 charts per month for review to measure documentation of screening and care plans. Results: Over a one year period, the majority of the 15 Network sites (13 of 15) reached at least 85% reliability in screening for sleep problems and constipation in children with ASD; and development and documentation of care plans for those with a positive screen. Preliminary outcome data suggests a majority of children showed improvement in these co-occurring conditions with early identification and first line intervention (75% constipation, 61% sleep).
Conclusions: This work describes a multi-institutional QI collaborative using a modified Institute for Health Improvement (IHI) Breakthrough Series to improve the identification and treatment of medical conditions seen frequently in individuals with ASD. Improvement was documented at all sites, with several meeting the pre-determined goals and most reaching high levels (85%) if not reaching the goal of 95%. Preliminary data indicated that the improvement in the clinical process was having an impact on the symptoms of those patients with identified conditions. QI methodology is an effective framework to impact change across a network of providers in unique healthcare settings. This effort can provide networks a framework to systematically implement standards of care across multiple medical settings.

163 **126.163** Increased Presence of Familial Psychiatric and Neurodevelopmental Disorders in Groups with Unclear or Negative Autism Spectrum Disorder Diagnosis in a State-Wide Autism Registry

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Background: Family history is important to consider in patients with Autism Spectrum Disorder (ASD) as literature has shown increased presence of familial psychiatric disorders compared to the general population. Psychiatric comorbidity is also high in ASD and associated with functional impairment and increased diagnostic challenges (Leyfner et al. 2006; Molloy et al. 2011). Disorders that are especially prevalent in these families include depression, bipolar, and anxiety disorders (Cohen & Tsiouris, 2006; Micali et al., 2004).
Objectives: To investigate differences in family psychiatric and neurodevelopmental history in individuals referred to an ASD research registry grouped by level of diagnostic confirmation and confidence.
Methods: Participants were the first 1,000 individuals enrolled in a state-wide autism registry (Male = 780; M_{age} = 13.6 years, SD = 9.6). Referrals were based on existing diagnosis or concern for ASD. Participants were categorized into three groups: (1) ASD (N = 533): having a community diagnosis of ASD confirmed by the ADOS-2; (2) ASD-unclear (N = 318): having an inconsistency between community diagnosis and ADOS-2 result; and (3) non-ASD (N = 101): having a negative ADOS and no community diagnosis. Family history was obtained by interview. Analyses examined group differences of individual disorders as well as composite scores of total number of neurodevelopmental and psychiatric disorders.
Results: Using one-way ANOVA and Tukey post-hoc tests, controlling for false-discovery rate, there was increased presence of multiple psychiatric and neurodevelopmental disorders in non-ASD and ASD-unclear groups as compared to ASD group. The overall number of psychiatric disorders in first-degree relatives was significantly higher in ASD-unclear (M = 2.15, SD = 2.05, F ((2, 862) = 14.0, $p < .001$) and non-ASD (M = 2.42, SD = 2.35, $p < .001$) as compared to ASD (M = 1.56, SD = 1.66). The non-ASD group reported more neurodevelopmental disorders in first-degree relatives (M = 1.62, SD = 1.70, p = .013) than the ASD group (M = 1.11, SD = 1.48). Follow-up analysis showed that probands in ASD-unclear (M= 2.3, SD = 1.7) and non-ASD groups (M= 2.5, SD = 1.7) had increased psychiatric comorbidities as compared to ASD group (mean = 1.58, SD = 1.5, F (3,546) = 16.1, p < .001). There was a significant positive correlation between number of psychiatric diagnoses in the proband and number of psychiatric disorders in first-degree relatives (r = .28, N = 550, p <.001). A linear regression was performed controlling for biologic sex and age (R^2 = 0.13, F (3, 546) = 25.92, β = .27, t = 6.8, $p < .001$), that confirmed a statistically significant association between number of first-degree family diagnoses and number of proband comorbidities.
Conclusions: Individuals in the ASD group had less family members affected with neurodevelopmental or psychiatric disorders and less psychiatric comorbidities as compared to ASD-unclear and non-ASD groups. This finding supports that registry referrals of ASD-unclear and non-ASD individuals are in part due to more complicated psychiatric presentation, and demonstrates the need for clinical tools that can aid in differentiating these groups.

164 **126.164** Increased Psychiatric Complexity of Autism Spectrum Disorder: Explaining Diagnostic Inconsistencies

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Background: Recent studies have indicated that the Autism Diagnostic Observation Schedule (ADOS) has reduced specificity in samples with a broad range of developmental and behavioral disorders (Molloy et al. 2011), and a pilot study found that “false-positive” ADOS results may be attributable to symptoms of co-morbid psychiatric conditions (Stadnick et al. 2015). However, literature has yet to appropriately quantify phenotypic characteristics of individuals with diagnostic inconsistencies in ADOS and community diagnosis.
Objectives: To identify whether clinical characteristics differ in individuals with discordance between community diagnosis and ADOS as compared to individuals with concordance in these same measures.
Methods: Â The sample was comprised of 762 individuals (ages 3 – 18; M_{age} = 13.27 years, SD = 9.45, 78.3% male) selected from a state-wide ASD registry. Participants entered the registry either with an existing diagnosis or due to a concern of an ASD. All participants were administered the ADOS-2 upon enrollment. Participants were grouped into four diagnostic categories depending on status of community diagnosis and ADOS-2 result: (1) Community ASD diagnosis and a positive ADOS-2 (N=533); (2) Community diagnosis and a negative ADOS-2 (N=54); (3) No community diagnosis and a positive ADOS-2 (N=109); and (4) No community diagnosis and a negative ADOS-2 (N=66). The presence of psychiatric diagnoses and the reports of current medications were obtained through caregiver-completed questionnaires. The number of different psychotropic medications were summed to create four dichotomous variables representing antidepressants, Attention-deficit/hyperactivity disorder (ADHD) medications, antipsychotics and mood stabilizers. Autism severity was measured by standardized scores available through a caregiver-completed Social Responsiveness Scale, Second Edition (SRS-2).
Results: A series of logistic regressions of co-morbid diagnoses with age and gender as covariates revealed that the discordant subgroups were more likely to have depression (χ^2 = 61.47, p < .001), anxiety (χ^2 = 51.93, p < .001), ADHD (χ^2 = 18.70, p = .002) and oppositional defiant disorder (χ^2 = 13.97, p = .016). Chi-square analyses revealed a significant difference between diagnostic groups and the likelihood of taking antipsychotic (p = .031) and ADHD (p = .020) medication. However, these effects did not survive follow-up logistic regression analyses controlling for age and gender. Further, there was a significant difference between diagnostic groups on SRS-2 severity (F(3,659) = 5.34; p = .001). Participants with a positive ADOS-2 result and community diagnosis scored higher on the SRS-2 compared to those with no ASD diagnosis (p= .003). Results support the sensitivity of the SRS-2 to measure ASD symptom severity in a subgroup more likely to have a true positive diagnosis.
Conclusions: Children presenting to an ASD registry with inconsistencies between community diagnosis and ADOS-2 findings had increased rates of caregiver-reported psychiatric diagnoses and psychotropic medications as compared to those whose ADOS-2 result was concordant with community diagnosis of ASD. The results concur with prior reports of reduced specificity of the ADOS-2 in the presence of co-occurring psychiatric symptoms. These findings are both empirically and clinically relevant, confirming the need for cautious interpretation of positive ADOS-2 results in the presence of psychiatric complexity.

165 **126.165** Interoceptive Sensibility Predicts Anxiety in Children on the Autism Spectrum

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Background: Anxiety is a major co-occurring feature of autism spectrum disorders (ASD). Interoception refers to the sensation of the internal state of the body including afferent information from the viscera, respiratory and genitourinary systems (Cameron, 2001). The incidence of anxiety symptoms in this population has been associated with problems with interoceptive processing (Garfinkel et al., 2016). Despite the developmental nature of autism, and findings of declining interoceptive accuracy with age (Khalsa et al., 2009), this relationship has only previously been investigated in adults.
Objectives: Here, we assessed the relative contribution of interoceptive dimensions to anxiety symptoms in autistic and typical children. Mirroring Garfinkel et al.’s previous research our hypotheses were that 1) a diagnosis of ASD will be associated with impaired interoceptive accuracy (reduced performance on an objective test of interoception); 2) individuals with ASD will display enhanced interoceptive sensibility (their subjective belief about their interoceptive aptitude); 3) the discrepancy between interoceptive accuracy and interoceptive sensibility, operationalised as interoceptive trait prediction error (ITPE), will be predictive of anxiety symptoms. In addition to this, extrapolating from Khalsa et al., (2009) we expect 4) interoceptive accuracy to decline with age, peaking in late childhood or early adolescence.
Methods: We assessed the interoceptive accuracy (using heartbeat detection tasks), interoceptive sensibility (subjective sensitivity to internal sensations on a self-report questionnaire), and state and trait anxiety of 20 children diagnosed with an ASD and 30 age-matched typically developing children, aged between 6 and 18 years.
Results: We found higher levels of anxiety in autistic children and adolescents than typically developing children on parent-report, but not self-report measures, and poorer interoceptive accuracy in autistic than typical children, replicating previous findings (Garfinkel et al., 2016). Intriguingly, we identified a significant negative relationship between age and interoceptive accuracy, whereby younger children had better interoceptive awareness in comparison with older adolescents, extending previous findings of a negative relationship (Khalsa, Rudrauf, & Tranel, 2009) into a younger sample. In contrast to findings in adults, we observed a negative relationship between ITPE and self-report anxiety, across the entire sample. In typical and autistic individuals, the best predictor of anxiety symptoms was interoceptive sensibility, the subjective report of interoceptive symptoms. The more interoceptive symptoms an individual reported, the higher their anxiety score.
Conclusions: The findings presented here support the notion that emotional processing difficulties in autism arise in part through a compromised interoceptive channel (Quattrocki & Friston, 2014). Reduced accuracy in the detection and prediction of interoceptive signals could disrupt their use in forming emotional inferences, causing uncertainty and anxiety about the external and internal world. Finally, these data underscore the need for research examining the characteristics of anxiety and interoception in autism within a developmental framework.

166 **126.166** Is There Sexual Dimorphism of Hyperserotonemia in Autism Spectrum Disorder?

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Background: Â Approximately 30% of individuals with autism spectrum disorder (ASD) have elevated whole blood serotonin (5-HT) levels (Gabriele et al. 2014). Genetic linkage and association studies of ASD and of whole blood 5-HT levels as a quantitative trait have revealed sexual dimorphism.
Objectives: Few studies have examined the effect of sex differences on hyperserotonemia within ASD. Based upon previous work suggesting that hyperserotonemia is more common prior to puberty, we focused our analysis on pre-pubertal children with ASD.
Methods: 292 participants with a diagnosis of Autistic Disorder, Asperger's Disorder, or Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS) were recruited based on the DSM-IV-TR criteria. ASD classification was confirmed using the Autism Diagnostic Observation Schedule (Lord et al. 2000) and the ADI-R (Lord et al. 1994). Participants who were taking medications that could affect 5-HT, such as serotonin reuptake inhibitors, stimulants, and atypical antipsychotic medications were excluded from analysis. Whole blood 5-HT was measured by high-performance liquid chromatography.
Results: We relied upon published norms to define the hyperserotonemia range as whole blood 5-HT levels above 270 mg/mL (Anderson, Freedman, et al., 1987; Anderson, Hertzig, & McBride, 2012). In the current study, 41% of pre-pubertal participants were in the hyperserotonemia range. Among 182 pre-pubertal children with ASD, the overall distribution of whole blood 5-HT levels showed a rightward shift from a normal distribution. Kolmogorov-Smirnov tests of normality indicated that whole blood 5-HT levels for pre- and post-pubertal females did not deviate significantly from normal (D(23)=0.15, p=.16; D(14)=0.13, p=.20); whereas distributions for pre- and post-pubertal males were abnormally distributed (D(157)=0.08, p=.005; D(70)=0.14, p=.001, respectively). The mean whole blood 5-HT levels were not significantly different for the male and female pre-pubertal populations (t(180) = 1.29, p = 0.19); however males were significantly more likely to have hyperserotonemia compared to females (x2 = 4.338, p = 0.03).
Conclusions: This represents the largest sample of subjects with ASD for whom whole blood 5-HT levels have been reported. Similar to previous studies, we found that a substantial subset of children with ASD had whole blood 5-HT levels in the hyperserotonemia range (Gabriele et al. 2014). In the pre-pubertal sample, we found that males with ASD are more likely to have hyperserotonemia than females. This may be consistent with the genetic literature identifying linkage to the 17q11 and 17q21 gene regions, containing SLC6A4 and ITGB3, respectively, in families with multiple affected males with ASD but not in families with affected females (Stone et al. 2004; Cantor et al. 2005; Sutcliffe et al. 2005), along with data showing association between these two genes and 5-HT levels in males within a large founder population (Weiss et al., 2005). More work will be needed to replicate this intriguing finding and to understand whether it relates to differences in patterns of ASD risk between males and females.

167 **126.167** Is the Latent Structure of Psychopathology the Same in ASD and Non-ASD Youths? Evidence from Multi-Group Invariance Testing

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Background: Psychiatric comorbidity within autism spectrum disorder (ASD) is highly prevalent, with rates surpassing those of the general population (Simonoff et al., 2008). Indeed, these comorbid conditions, rather than ASD itself, are often the presenting complaint for psychiatric evaluations in youths (Gadow et al., 2004). Currently, there is considerable interest in whether these comorbidities represent true co-occurring disorders, or whether they are a unique manifestation of ASD-specific symptoms (i.e., ASD epiphenomenon; Wood & Gadow, 2010). Research suggests that common psychiatric disorders co-occur at high rates by virtue of their associations with core transdiagnostic internalizing (mood and anxiety disorders) and externalizing (e.g., ADHD, ODD, and conduct disorder) factors (e.g., Eaton et al., 2015). However, no research has examined this transdiagnostic comorbidity framework in ASD youths or characterized the degree to which it differs between psychiatric referrals with and without an ASD diagnosis.
Objectives: Â The primary purpose of this study was to examine the extent to which differences in symptoms of common mood, anxiety, and behavioral disorders among youths with ASD—when compared to psychiatric controls without ASD—might be explained by differences in latent transdiagnostic comorbidity factors.
Methods: Â Participants were 6-18 year olds (N=1,223), either referred for evaluation in a developmental disabilities clinic and diagnosed with ASD (N=280; M_{age} =10.7, SD_{age}=3.4) or referred to a psychiatry outpatient clinic with no ASD diagnosis (N=943; M_{age} = 12.1, SD_{age}=3.4).Â Comorbid symptoms were measured using the CASI-4R (Gadow & Sprafkin, 2005) parent-report. Using confirmatory factor analysis (Figure 1), we investigated the measurement invariance of transdiagnostic factors across ASD and non-ASD groups.
Results: Â Measurement invariance analyses suggested that latent transdiagnostic factors were comparable, such that the same symptoms related to each factor and had the same meaning (e.g., symptoms showed similar factor loadings) across groups. However, important group-specific differences in mean parent-rated social anxiety and ADHD symptomatology were observed (Table 1).
Conclusions: Â These findings suggest that elevated symptomatology of common mood, anxiety, and behavioral disorders in ASD youths—when compared with their non-ASD counterparts—can be largely explained by differences at the latent transdiagnostic comorbidity level, and are not necessarily as a result of epiphenomena of the ASD diathesis. Exceptions to this rule, however, apply. A diagnosis of ASD was associated with elevated symptomatology for social anxiety and ADHD regardless of transdiagnostic factors levels. These findings may be explained in part by 1) the strong genetic overlap of ASD and ADHD (e.g., Rommelse et al., 2010), 2) social deficits of ASD that may make youths more vulnerable to social stressors and subsequent anxiety (e.g., Bellini, 2004) and 3) symptom overlap which leads parents to perceive greater social anxiety and ADHD symptoms in ASD youths. Therefore, while differences in internalizing and externalizing levels can explain the heightened comorbidity of psychiatric conditions seen in ASD youths, it appears that elevated symptomatology of social anxiety and ADHD specifically may also be partially understood as specific to the ASD diagnosis.

168 **126.168** Item-Level Analysis of the Intolerance of Uncertainty Scale in Youth with ASD

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Background:
Intolerance of uncertainty (IU) is a transdiagnostic construct in which individuals experience negative emotional, behavioral, and cognitive reactions to uncertain situations. In typically developing (TD) individuals, IU has been associated with anxiety, obsessive-compulsive disorder, and depression. Multiple studies have reported higher rates of IU in youth with ASD compared to TD peers (Chamberlain et al., 2013; Kreiser et al., 2016). IU has also been increasingly identified as a key variable in the relationship between ASD and anxiety. It has been found to mediate the relationship between ASD and anxiety (Boulter et al., 2014), to predict outcomes of CBT for anxiety (Keefer et al., 2016), and to be associated with ASD symptoms when controlling for anxiety (Neil et al., 2016; Kreiser et al., 2016). Thus far, the main tool to assess IU has been the Intolerance of Uncertainty Scale (IUS). Studies that have used this instrument have examined total IUS scores, and no studies have examined whether specific IU traits may be particularly heightened in youth with ASD.
Objectives:
To examine differences in the 27 questions on the IUS between youth with ASD and TD controls using parent and child report.
Methods:
One hundred and sixteen youth, 8 through 16 years, and 97 parents were enrolled for this study from ongoing research studies. Two groups of children were examined: children with ASD and TD children without psychopathology. All participants in the ASD group were well-characterized using the ADOS/ADOS-2, ADI-R and WISC-IV (VCI greater than 70). IU was assessed using the Intolerance of Uncertainty Scale for Children, Parent and Child Report (IUS-P, IUS-C; Comer et al., 2009), a 27 item rating scale which has demonstrated good internal consistency in the ASD population (Kreiser et al., 2016) and in TD youth (Comer et al., 2009).
Results:
Results of the logistic regression analysis indicated that children with ASD reported significantly higher scores on ten IUS-C items compared to TD controls (See Table 1). Seven of these ten items have themes of negative emotions ("I can't relax," "I get frustrated") and cognitions ("It makes life hard," "It's not fair," "It's hard for me to have fun," "I am not great.") when experiencing uncertainty. Additional items contained themes related to "behavioral paralysis," which refers to avoidant-oriented responses to uncertainty. The highest odd ratio was associated with the item, "Being unsure of things means I am not great," indicating a connection between high IU and negative self-appraisal. Parents, however, reported broad based differences in IU with 20 items that were significantly greater in the ASD group compared to the control group. These items overlapped with most child report items, and similarly contained themes of negative emotions and cognitions, as well as "behavioral paralysis".
Conclusions:
Children with ASD report dysphoric emotions and cognitions when experiencing IU. This suggests that IU may be associated with different types of psychopathology including depression, irritability, and behavioral dysregulation. Clinicians may consider incorporating questions about IU in their mental health assessment and in the development of psychosocial interventions for youth with ASD.

169 **126.169** Language and Social Communication in Children with ASD: Longitudinal Impact on Anxiety and Externalizing Behaviors

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Background: Anxiety disorders are prevalent in about 40% of youth with an Autism Spectrum Disorder (ASD) (Jennett et al., 2013). It is still unclear whether or not anxiety functions in the same manner in children with ASD and those who are typically developing (TD). Children with ASD also present with higher levels of externalizing behaviors when compared to their TD peers (Kanne & Mazurek, 2011). Research has demonstrated that anxious children with ASD who present with co-occurring externalizing behaviors, are at greater risk for heightened anxiety symptomotology as well as to have an attenuated response to treatment (Stoch et al., 2012).
The influence of language abilities on the development of anxiety disorders has been understudied in children with ASD. In typically developing children, communication difficulties such as a stuttering, have been associated with higher levels of anxiety symptoms (Beitchman et al., 2001). However, in children with ASD, anxiety is actually more prevalent in those who are higher functioning and more verbal (Davis et al., 2011). Research findings examining the relationship between language and externalizing behavior problems in children with ASD have been mixed (Sipes et al., 2011; Matson et al., 2009). It is likely that different language domains are driving the differential findings among the research base. Thus, it is essential to determine the impact of specific language domains on anxiety and disruptive externalizing behaviors in order to help clarify conflicting findings in the literature.
Objectives: The primary aim of this study was to examine effects of language production and social communication on anxiety and co-occurring externalizing behaviors in young children with ASD. We examined the following research questions: 1a) To what extent does language production relate to child anxiety in young children with ASD over time? 1b) To what extent does social communication relate to child anxiety in young children with ASD over time? 2a) To what extent does language production relate to child externalizing behaviors in young children with ASD over time? 2b) To what extent does social communication relate to child externalizing behaviors in young children with ASD over time?
Methods: Participants were 126 children with ASD, ages 4 to 7 years and their mothers, who were recruited for a larger study examining the transition to early schooling for children with ASD and their families. Children were included in this study if their Full Scale IQ was above 70 (mean= 93.6, SD= 12.8), and English was their primary spoken language. Utilizing structural equation modeling we examined relationships among language production, social communication, anxiety symptoms, and externalizing behaviors.
Results *:* Social communication, but not language production, was inversely related to child anxiety (*ß*= -.64, $p<.05$) and co-occurring externalizing behaviors (*ß*= -.62, $p<.05$).
Conclusion*s:* These findings suggest that children with ASD may be at heightened risk for anxiety and externalizing disorders due to their social communication deficits rather than to their language production deficits at large.

170 **126.170** Measurement of Multiple Radical Scavenging Activity As a Diagnostic Method for Autism Spectrum Disorder in Children

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Background: Oxidative stress plays a central role in the pathogenesis of autism spectrum disorders (ASD). Though early interventions are important, ASDs are rarely diagnosed in toddlers, because diagnosis is based deeply on psychological assessment and observation.
Objectives: We investigated the availability of the measurements of multiple free radical scavenging activity (MULTIS) as a novel diagnostic tool for ASD children.
Methods: Serum samples from ASD children and neurotypical children (NT) were analyzed under informed consents. This study enrolled 23 children (3.9±0.8 y.o.) with ASD recruited at the Miyagi children's hospital (Sendai, Japan) and 34 age-matched NT recruited by advertisement. DSM-IV-TR diagnosis of autistic disorder was made for all subjects. Fasting human blood samples were collected by venipuncture in a sitting position with a tourniquet from all participants for both groups who are Japanese and drug-naïve. In MULTIS method, serum scavenging-activity profile against 5 reactive oxygen species, namely .OH, O2.-, RO., ROO. and 1O2 were measured using spin traps CYPMPO and TMPO (Oowada S et al., J Clin Biochem Nutr. 2012;51:117-21.).
Results: Scavenging activity against was significantly decreased in ASD group (approximately 55% of NT group mean value). Contrary to .OH, scavenging activities against O2.- and RO. were significantly increased in ASD group (approximately 120% and 157% of NT group mean values, respectively). No differences were observed in ROO. and 1O2 among the two groups. When diagnostic criteria for ASD was made using .OH, O2.- and RO. scavenging activities, the calculated sensitivity, specificity and positive likelihood ratio were 65%, 93% and 9.78, respectively. Moreover, when the data of ROO. and 1O2 were added, the positive likelihood ratio increased to 22.17.
Conclusions: Measurements of serum multiple free radical scavenging activity by MULTIS method could be a very powerful non-behavioral tool for diagnosis of ASD children.

171 **126.171** Need for Valid, Reliable Gastrointestinal Symptoms Measurement Tool for Autism Spectrum Disorder, a Review of the Literature

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Background:
Gastrointestinal symptoms (GI) have been implicated in Autism Spectrum Disorder (ASD), and the purported association between GI symptoms and ASD has fueled the development of dietary interventions that claim to repair a damaged gut, and to improve GI and core ASD symptoms. However, there is no validated tool for measuring GI symptoms in this population and therefore no valid estimate of GI symptoms.
Objectives:
The purposes of this review were to 1) describe approaches used to measure GI symptoms, 2) summarize GI prevalence estimates across studies, and 3) discuss how the measurement variation affects GI symptom estimates.
Methods:
PubMed was used to find ASD studies published between 1980-2016 that measured GI symptoms/diagnoses. For inclusion, studies were required to have 10 or more individuals with ASD; review articles, meta-analyses, hypotheses papers, narratives or editorials, and animal studies were excluded. From these studies, we extracted study characteristics as well as information on how GI symptoms/diagnoses were measured. To ascertain a range of estimates of GI symptom prevalence, we further refined this set of studies by excluding those in which sampling was based on GI symptoms/diagnoses, that included or excluded participants based on diet, or that were experimental.
Results:
Of the 357 studies returned from PubMed, 132 met our inclusion criteria for description of GI measurement. The publication dates ranged from 1986 to 2016. Fifty-five studies were clinic-based, 18 were population-based, 2 were enriched-risk, and 57 studies did not have enough information to assess the type of sample. There were 55 case-control studies, 32 cross-sectional studies, 15 cross-sectional studies with a comparison group (such as history of regression), 24 experimental studies, 1 study with both a case-control and experimental sample, and 5 cohort studies. Studies used the following methods to assess GI symptoms/diagnoses: parents/caregivers questionnaires (n=73), medical records (n=15), parents/caregivers as well as medical records, physician, teacher, or self-report (n=27). Seventeen studies did not specify who reported GI symptoms/diagnoses. Of the 110 studies that used a questionnaire for assessment, 61 used their own tool, while 49 studies used or modified an existing tool. Popular questionnaire options included the Rome III criteria (n=11), the GI severity index (n=5), and the Autism Treatment Network GI Symptom Inventory (n=3). Of the 78 studies that were kept for the prevalence estimates, the range of estimates for variables including an aggregate of GI symptoms or counting any GI symptom was 4.2-96.8% (median 47.1%). The range for estimates for diarrhea specifically was 2.3-75.6% (median 14.6%), and constipation 4.3-45.5% (median 21.4%). GI symptom estimates were significantly associated with the type of study sample and the method for reporting symptoms/diagnoses ($p<0.05$).
Conclusions:
This study reviewed the breadth of approaches to measuring GI symptoms in studies of ASD. The type of study sample and approaches used to measure GI symptoms were significantly associated with the estimated GI symptom prevalence. The range of GI symptom estimates was wide, highlighting the need for a reliable, valid tool to be used consistently across studies measuring GI symptoms in ASD studies.

172 **126.172** Needs Assessment for the Development of an Evidence Based Practice to Support Teens with Co-Occurring ASD and Gender Dysphoria

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Background: ASD and gender dysphoria (GD) often co-occur (de Vries et al., 2010; Strang et al., 2014), and the co-occurrence presents diagnostic/treatment challenges (Strang et al., 2016). Models for pediatric GD care programs exist (e.g., Menvielle et al., 2012), but there are no studies of clinical service models to address the needs of GD youth with ASD.
Objectives: Address two primary questions: What are the concerns/needs of youth with ASD and GD? How can a therapeutic group program best support youth with this co-occurrence and their families?
Methods: As part of a gender discernment/support group program for youth with GD and ASD, we conducted in-depth needs assessments with twenty-one participants (13 parents and 8 youth with ASD and GD) through written feedback following group sessions, and interviews (transcribed verbatim) at the completion of one year in the program. Framework Analyses (Ritchie et al., 2003) were conducted using *Dedoose* (SocioCultural Research Consultants, 2016) to identify and organize themes, with separate schema for youth and parents due to contrasts in themes between the groups. A consensus approach was employed to avoid relying on a single researcher's perspective. As a final validity check, the frameworks were presented to the participants to ensure they reflected their experiences.
Results: Youth data organized into primary themes: the significance of finding connection with others who have GD and ASD; a wish to increase social connections with group members, though awareness that ASD interferes with social connections; and the importance of role models of gender outcomes (i.e., community adult visitors to group who reflect a range of gender outcomes). Youth data revealed little concern with real-world challenges of ASD or GD, excepting specific focus on gender-related medical treatments. The parent framework included: a strong parent need for education and resources (e.g., legal and medical aspects of gender transition); the centrality of challenges related to ASD (i.e., GD may be the most noticeable issue at first, but it is less impactful than the ASD); and a significant parent concern regarding real-world gender and ASD challenges (school, transition to adulthood, college, informing extended family regarding gender transition). A comparison between youth and parent data identified one common theme: the unique/meaningful quality of acceptance/community provided by a group specifically for GD and ASD. Contrasts between youth and parents included: youth tended to focus on the social nature of the group, whereas parents focused on the practical needs of their children; the overall tone of the youth was less worried and more hopeful than that of their parents; and the youth focused primarily on gender, whereas their parents focused initially on gender, and increasingly on the challenges/demands of ASD over time.
Conclusions: This is the first study to directly capture the voices, experiences and needs of individuals with ASD and GD and their families. Primary themes for developing an evidence-based group program include the importance of concrete exemplars of a range of gender outcomes, as well as blending of support group and ASD intervention group models for group treatment.

173 **126.173** Parent-Child Informant Discrepancies of Social Anxiety in ASD Relate to ASD Symptoms and Adaptive Functioning

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Background: Social anxiety is highly comorbid with autism spectrum disorder (ASD), and impairs individuals' adaptive responses in daily life. Parents and youth often endorse discrepant levels of youth anxiety, which may be exacerbated by the socio-communicative impairments inherent to ASD. However, despite best-practices calling for gathering information from multiple informants, little research has comprehensively evaluated correlates of parent-child informant discrepancies (PCIDs) for social anxiety in youth with and without autism spectrum disorder (ASD).
Objectives: This study examined PCIDs for social anxiety symptoms in youth with ASD and an age-matched typically-developing comparison sample (COM), and factors that moderate the extent of disagreement.
Methods: Participants included 223 verbally-fluent (i.e., verbal IQ>70) children and adolescents (8 to 16 years old, 110 ASD, 113 COM) and their parents, who completed the Social Anxiety Scale for Children, Revised (SASC-R; La Greca & Stone, 1993). Parents also completed the Social Communication Questionnaire (SCQ; Berument et al. 1999) assessing the child's autism symptoms and the Behavior Assessment System for Children (BASC-2; Reynolds, 2010) to measure adaptive functioning.
Results: A two (informant: parent, youth) by two (group: ASD, COM) repeated-measures ANCOVA on SASC scores revealed that participants with ASD (M_{adj}=49.90, *SE*=1.00) were rated as having higher social anxiety than COM participants [M_{adj}=35.57, *SE*=0.99; *F*(1, 219)=98.06, *p*<.001]. Informant discrepancies were lower, but more variable in the ASD group, relative to COM participants, *F*(1, 219)=7.67, *p*=.006, Levene's Test of Error Variances: F(1, 221)=12.06, *p*=.001 (Figure 1). We then assessed whether the PCIDs of social anxiety were related to demographic and diagnostic characteristics using polynomial regression analyses (Laird & Weems, 2013). In this model, patterns of agreement or discrepancy are characterized using an interaction between parent and youth informants' reports, controlling for main effects (linear and quadratic) of each informant. Informant agreement was not related to demographic factors of age, or verbal IQ for either group (Table 1). In the ASD group, youth autism symptoms (SCQ) and adaptive functioning (BASC) were related to PCIDs, such that profiles that agreed on youth anxiety symptoms had lower lifetime autism symptoms and better adaptive skills. A different pattern emerged in the COM group, where youth that agreed with their parents on high anxiety symptoms had the lowest adaptive skills.
Conclusions: This was the first study to assess PCIDs of social anxiety using polynomial regression analyses, which allow examination of different profiles of agreement and discrepancy. Given the group differences in the degree and variability of PCIDs, it appears that youth with ASD do not reliably differ from their parents on reports of social anxiety, highlighting the importance of characterizing correlates of PCIDs in this group. PCIDs of social anxiety were not related to verbal IQ or age for either group, indicating that demographic factors likely do not influence the accuracy of informant reports of anxiety. Associations between PCIDs and outcomes indicate that for individuals with ASD, parent-child agreement on level of youth anxiety, be it high or low, was related to better outcomes. Implications for clinical and research practices are discussed.

174 **126.174** Parent-Reported Sleep Problems in Children with Comorbid Autism Spectrum Disorder and Attention-Deficit/Hyperactivity Disorder

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Background:
Sleep problems are frequent and well documented in children with Autism Spectrum Disorder (ASD), children with Attention Deficit/Hyperactivity Disorder (ADHD) and children with anxiety. Anxiety is also highly prevalent in children with ASD and ADHD: Up to 84% of children with ASD report anxiety symptoms, and 25% of children with ADHD meet criteria for co-occurring anxiety disorders. Although the prevalence of sleep problems has been well documented within each pure diagnosis, limited work has examined sleep problems and anxiety levels in children presenting with comorbid ASD/ADHD.
Objectives:
The objectives of the current study were to: 1) determine which diagnostic factors are related to problematic sleep behaviors in children with comorbid ASD/ADHD; and 2) to assess the association between problematic sleep behaviors and functional impairment in this sample specific to academic performance, intellectual functioning, and executive functioning. We expected that 1) increased ASD, ADHD, and anxiety symptom severity would predict elevated levels of problematic sleep behaviors, and 2) that more severe problematic sleep behaviors would predict increased academic, cognitive, and executive functioning difficulties over and above ASD and ADHD diagnostic severity and anxiety symptom severity.
Methods:
Participants were 85 children (*M* age = 9.29, *SD* = 1.79; range = 6.66 – 12.91; 64 boys) who met DSM-IV criteria for both autism and ADHD. Sleep, anxiety, intellectual functioning, academic achievement and executive functioning were assessed. Hierarchical linear regression analyses were completed to determine the relationship between anxiety symptom severity, ASD symptom severity, ADHD severity, and total problematic sleep behavior. Multivariate regressions examining the link between problematic sleep behaviors and functional outcomes (i.e., academic performance, intellectual functioning, executive functioning), using anxiety symptoms severity, ASD symptom severity and ADHD symptom severity as predictor variables were also completed.
Results:
Parent-reported child anxiety significantly predicted parent-report of their child having nightmares (R^2_{change} = 0.078, F_{change} = 7.036, β = 0.253, p = .010), being overtired for no reason (R^2_{change} = 0.132, F_{change} = 12.448, β = 0.347, p < .001), and their total problematic sleep behaviors score (R^2_{change} = 0.091, F_{change} = 8.221, β = 0.226, p = .005). ASD and ADHD severity did not significantly predict any sleep behaviors. Parent report of sleeping more than other children significantly predicted increased verbal IQ (F = 5.345, p = .023), and better sentence comprehension (F = 5.708, p = .019) and math computation (F = 5.296, p = .052), with a trend towards significance for spelling (F = 3.732, p = .057) over and above ASD, ADHD, or anxiety symptomology.
Conclusions:
Results suggest that anxiety is the most consistent predictor of problematic sleep behaviors in children with comorbid ASD/ADHD, and that increased sleep may be beneficial for children with comorbid ASD and ADHD. Further, our results indicate that anxiety symptoms play a significant role in problematic sleep behavior in children with ASD and ADHD. Clinically, these results imply children with ASD who present with problematic sleep behaviors should receive a comprehensive evaluation to identify specific problematic sleep behaviors and their potential relationship with anxiety.

175 **126.175** Prevalence and Clinical Features of Suicidal Ideation in Cognitively Able Children and Adolescents with Autism Spectrum Disorder

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Background: Some of the most prevalent risk factors associated with suicidal behavior include impulsive/aggressive tendencies, social isolation, bullying, anxiety, and depression; all of which are well-documented areas of difficulty for individuals with autism spectrum disorder (ASD). The limited research on this topic in adults with ASD has reported abnormally high rates of suicidal ideation (66%) and suicidal plans/attempts (35%; Cassidy et al., 2014; Paquette-Smith, Weiss, & Lunsky, 2014). In the two studies that have examined this topic in children/adolescents with ASD, elevated rates of suicidal ideation (11-14%) were observed, even at these young ages (Dickerson-Mayes et al., 2013; Storch et al., 2013). As a history of previous suicidal behavior is one of the greatest predictors of suicide attempts, it is of critical importance that additional research investigates the prevalence, predictors, and indicators of suicidal ideation in youth with ASD, so focused efforts can be made to identify those at risk and provide pre-emptive intervention.
Objectives: Â The current study investigates prevalence rates and clinical features representing risk factors and/or warning signs for suicidal ideation in youths with ASD.
Methods: Collected as part a larger program of research, the sample for this study was comprised of 34 youth with ASD (28 male, 6 female; *M*=13.8 years-old) and 30 typical developing (TD) youth controls (15 male, 15 female; *M*=13.0 years-old). Groups were matched on IQ (DAS-II GCA) and age (Table 1). Suicidal ideation was assessed by parent-report of whether their child "talks about killing self" over the past 6-months, as reported on the CBCL. Clinical features examined as risk factors were assessed by both parent-report (CBCL, MASC-P, SRS-2) and child-report (MASC-C). Data collection is ongoing.
Results: Suicidal ideation was endorsed by parents of six (17.65%) children with ASD, as compared to one (3.33%) child with TD [$X^2(1)=3.73$, $p=0.05$]. Examining solely the ASD sample, none of the demographic variables (age, gender, ethnicity) were significantly associated with suicidal ideation ($0.28<ps<0.53$). Stronger cognitive abilities (IQ) were marginally associated with suicidal ideation ($r=0.33$, $p=0.06$). Although degree of ASD symptomology severity (SRS-2) was not significantly associated with suicidal ideation ($p=0.51$), multiple clinical features (assessed by the CBCL and MASC-C/P), associated with aggressive behaviors, internalizing problems, oppositional-defiant problems, feelings of humiliation/rejection, and parent-reports of overall anxiety, were significantly correlated with suicidal ideation (detailed in Table 2).
Conclusions: In line with previous findings, children/adolescents with ASD presented with elevated rates of suicidal ideation as compared to a matched TD sample. The observed relationships between suicidal ideation and clinical features provide information about potential risk factors (keeping problems internalized, increased concerns over being teased and/or viewed negatively by others) and warning signs (aggressive or defiant behaviors, elevated presence of observable symptoms of anxiety) of suicidal ideation in youth with ASD. Such information can provide guidance for future interventions (e.g. developing skills around sharing and communicating problems), and insight for preventative efforts [e.g. encouraging caregivers/teachers/practitioners to recognize the manifestations of problematic behaviors (such as aggression, defiance, anxiety), as potential indicators of underlying emotional issues that may eventually result in suicidal thoughts/behaviors].

176 **126.176** Relation of Social Anhedonia with Social Anxiety, Depression and Schizophrenia Symptoms in ASD and Psychiatry Referrals.

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Background: Social anhedonia (SA), a preference for being alone, is an accepted symptom phenotype in autism spectrum disorder (ASD), depression (MDE), and schizophrenia spectrum disorder (SSD); nevertheless, it remains under-investigated. It is unknown what drives SA in ASD: lack of pleasure from social interaction, social anxiety or fear of social humiliation (Asendorpf, 1990), or lack of skills to engage in social interaction.
Objectives: We sought to characterize the clinical correlates of SA and social anxiety in youth with ASD and non-ASD psychiatry referrals. To distinguish between fear of, versus desire for, social interaction, we investigated co-occurring social anxiety and SA. First, we characterized the prevalence and severity of SA and social anxiety between clinical groups. Next, within the ASD sample, we explored whether youth with SA evidenced more severe social deficits, social anxiety versus other forms of anxiety, and co-occurring commonly studied clinical correlates such as MDE, SSD and intellectual disability (ID).
Methods: Â Participants were youth with ASD (*N*=283) and non-ASD psychiatry referrals (*N*=653) between 6-18 years. Parents completed assessment batteries including the *Child and Adolescent Symptom Inventory–4R* (CASI-4R; Gadow & Sprafkin, 2005), *Parent Questionnaire* (Gadow et al., 2008), and *Social Communication Questionnaire Lifetime Version* (SCQ; Berument et al., 1999). Based on CASI-4R, youth were considered: socially anhedonic (**SA**), diminished social interaction (**DS**), or none (**NONE**).
Results: Â Rates of SA were higher in ASD (33%) than non-ASD clinic referrals (10%; $X^2(2) = 138.64$, $p < .001$). Similarly, rates of social anxiety disorder were higher in ASD (28%) than non-ASD youth (13%; $X^2(2) = 19.38$, $p < .001$). Among ASD youth, social anxiety disorder rates were significantly greater for SA (49%) compared to DS (30%) and NONE (7%; $X^2(2) = 39.88$, $p < .001$). There was a significant main effect for SCQ social deficits ($F = 19.4$, $p < .001$) in ASD; Tukey's post-hoc showed SA and DS youth were comparable but more severe than NONE ($p < .001$). There was a significant main effect for social anxiety disorder symptoms ($F = 24.2$, $p < .001$) in ASD; Tukey's post hoc showed SA youth evidenced more symptoms (but not other anxiety disorder symptoms) than both DS and NONE ($p < .001$). In contrast, non-ASD SA youth evinced greater symptoms of social *and* non-social anxiety disorders compared to DS and NONE (all $p < .05$). A main effect was found for MDE and SSD ($F > 12.3$, $p < .001$) in ASD; Tukey's post hoc showed that SA youth evinced more symptoms than DS and NONE for both disorders ($p < .001$). SA was not associated with ID in ASD youth ($X^2(2) = 3.15$, $p > .05$).
Conclusions: Â SA was found to be more common in ASD than non-ASD psychiatry referrals, yet it is not a defining characteristic of ASD. More importantly, only within ASD, SA youth evinced more social anxiety disorder symptoms but *not* other anxiety disorder symptoms compared to DS youth, suggesting that social anxiety may be driving SA. Interventions targeting social anxiety may therefore benefit SA youth.

177 **126.177** Relationship Between ASD Symptomology, Intellectual Functioning, and Seizure History in Children with ASD

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Background: Â Autism Spectrum Disorder (ASD) and epilepsy frequently co-occur, and despite similarly identified genetic contributors, it is unclear how shared etiologies are driving the association and how seizures impact ASD symptomology (Gilby & O'brien, 2013). ASD-epilepsy comorbidity has been associated with greater impairment in adaptive functioning, motor skills, and severity of autism, with severity often defined as level of intellectual functioning (Robinson, 2012; Turk, 2009; Viscindi et al., 2014). Additionally, increased rates of restricted and repetitive behaviors have been reported in individuals with comorbid ASD-epilepsy distinguishing them from individuals with ASD alone even when accounting for intellectual disability (Cuccaro et al., 2012).
Objectives: Â First, to explore the ASD symptomology profile associated with ASD and history of seizures or ASD alone in a sample of children ascertained for ASD. Second, to further examine the relation between seizure history, autism symptoms, and cognitive functioning
Methods: Our preliminary analyses included data from 110 children and young adults with ASD between ages of 4 years and 21 years with no reported history of seizures (n = 81, Male = 81%) and a history of non-febrile seizures (n = 30, Male = 73%). Seizure history was defined by parent interview. ASD symptomology was characterized using the ADOS-2 subdomain totals and ADI-R domain totals. Full Scale IQ Standard Score was derived from the Differential Ability Scale for Children (DAS-II; Elliot, 1990) with subjects stratified into IQ equal or higher than 70 (58%) and IQ lower than 70 (47%). Two MANCOVAs examined the effects of IQ status and seizure history (ASD+No Seizure History vs. ASD + History of Seizures) on parent derived ASD symptom scores (ADI-R subdomain totals) and clinician derived ASD symptom scores (ADOS-2 subdomain totals), controlling for current anti-seizure medication use.
Results: There were no significant multivariate effects or interactions for parent derived ASD symptoms. Significant main effects were found on the clinician derived ASD symptoms for IQ status, $F(3,97) = 14.73$, $p < .001$, Wilk's Lambda = .687 and seizure history, $F(3, 97) = 4.94$, $p = .003$, Wilk's Lambda = .876. A trend for the interaction between groups was observed, $F(3, 97) = 2.67$, $p = .052$, Wilk's Lambda = .924 (see Figure 1). Post hoc testing indicated this interaction was significant for only the behavioral subdomain, $F(1, 98) = 6.43$, $p = .013$, such that children with higher IQ and with a positive seizure history showed significantly lower restricted and repetitive behaviors compared to children without a history of seizures or children with a seizure history and IQ below 70.
Conclusions: Â Results suggest patterns of autism symptoms are associated with seizure history and intellectual functioning with greater ASD impairment associated with intellectual disability.Â Findings also reveal independent and interactive effects of intellectual functioning and seizure history on ASD symptomology particularly in the area of restricted and repetitive behaviors. Specifically, children with ASD, seizure history, and without intellectual disability demonstrated significantly less behavioral symptoms, suggesting a protective contribution of cognitive functioning in this group.

178 **126.178** Relationship Between Medical Comorbidity and Problem Behavior in Children with Autism Spectrum Disorder

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Background: Medical comorbidities, such as gastrointestinal and neurological disorders, in children with autism spectrum disorder (ASD) are relatively common and may have a negative impact on existing behavior problems related to an ASD diagnosis. The prevalence and type of medical comorbidities within the severely affected ASD patient population remains unclear. An improved understanding of medical comorbidities and their relationship to problem behavior has significant implications for treatment.
Objectives: To examine the prevalence of medical comorbidities within the Autism Inpatient Collection (AIC) sample, and to examine the relationship between common medical comorbidities and behavioral problems among severely affected children with ASD.
Methods: Data for this analysis were collected as part of a prospective study (AIC) examining phenotype, behavioral, and genetic data of children with ASD recruited from six specialized inpatient psychiatric units. Three-hundred and fifty children with ADOS-2-confirmed ASD enrolled in the AIC between February 2014 and October 2015 were included in this analysis. Medical comorbidities for each participant were collected from Axis III discharge diagnoses and categorized by ICD-10 code. To quantify severity of behavioral problems, the Aberrant Behavior Checklist-Irritability subscale (ABC-I) was completed at admission by a primary caregiver. Data analysis consisted of frequency and proportion calculations for ICD-10 categories, as well as t-tests to examine the relationship of medical comorbidities and ABC-I scores.
Results: The average age of the total sample was 12.9 years (*SD*=3.3, range 4-21), 79% were male, 79% Caucasian, and 93% non-Hispanic/non-Latino, with an average length of hospital stay of 25.6 days (*SD*=23.8, range 3-163). Sixty-percent of the sample (n=211) was diagnosed with at least one Axis III medical condition. Of those, 23.7% (n=83) had one diagnosis, 17.1% (n=60) had two, 10.0% (n=35) had three, 6.6% (n=23) had four, and 2.6% (n=9) with five diagnoses. Medical comorbidities were categorized by ICD-10 diagnostic groups. Of the 446 total diagnoses, the following categories were most prevalent: endocrine/nutritional/metabolic diseases (20.4%, n=91), diseases of the digestive system (14.8%, n=66), diseases of the respiratory system (11.7%, n=52), and diseases of the nervous system (11.4%, n=51) (see Figure 1). There were no significant differences in mean admission ABC-I scores between patients with any Axis III diagnosis (mean=27.96, SD=9.24) compared to those without (mean=26.47, SD=9.49), *p*=0.182. Further investigation by type of comorbidity (using ICD-10 categories with greater than 50 diagnoses in the sample as a cut-off) indicated subjects with at least one nervous system comorbidity (such as epilepsy, sleep disorder, or migraines) had significantly higher ABC-I scores (mean=29.98, SD=9.97) than those with no medical comorbidities (mean=26.47, SD=2.49), *p*=0.04.
Conclusions: Endocrine, gastrointestinal, respiratory, and nervous system disorders were found to be the most prevalent medical comorbidities in this inpatient sample. Behavioral severity for subjects with at least one nervous system problem was significantly higher on average than those with no medical problems, and merits further investigation. Targeting treatment of seizure and sleep disorders and other neurologic problems may play a role in decreasing the severity of problem behaviors.

179 **126.179** Relationships Between Social Anhedonia, Capacity for Social Pleasure, Loneliness, and Depressive Symptoms in Adults with Autism Spectrum Disorder and Typically Developing Never-Depressed and Depressed Comparisons

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Background: The social motivation hypothesis posits that individuals with Autism Spectrum Disorder (ASD) experience reduced levels of social pleasure and hedonic capacity for interpersonal and social rewards. In typically developing (TD) adults, especially among those with depression, such deficits have also been associated with increased loneliness. Exploring the relationships between measures of social motivation and loneliness with depressive and autism symptoms allows for a deeper understanding of the social experience of adults with ASD, including those with the common comorbidity of depression.
Objectives: The present study investigated the relationship between social pleasure, social anhedonia, and loneliness, as well as measures of depressive symptoms and ASD traits, in adults with ASD, TD currently depressed adults, and TD non-depressed controls.
Methods: A total of n=57 adults aged 18-35 with verbal IQ>80 were recruited from three cohorts: ASD (n=23); TD with current depressive disorders (DEP, n=19); and TD comparison participants with no depression or anxiety history (TDC, n=15). All participants completed diagnostic screening and testing (including the Autism Diagnostic Observation Schedule [ADOS-2] and the Structured Clinical Interview for DSM-5 Disorders [SCID-5]), as well as self-report measures of capacity to experience social pleasure (Anticipatory and Consummatory Interpersonal Pleasure Scale; ACIPS), social anhedonia (Revised Social Anhedonia Scale; RSAS), and loneliness (Loneliness in Context Questionnaire; LiCQ). Participants also provided self-reported measures of autism spectrum traits (Autism Spectrum Quotient; AQ) and depressive symptoms (Beck Depression Inventory-II; BDI).
Results: The ASD and DEP groups were not statistically different from each other on social interest/anhedonia measures (ACIPS and RSAS), though they showed less social interest and increased anhedonia compared to the TDC group. As a group, ASD reported greater loneliness than TDC but less loneliness than DEP. Within ASD, increased social anhedonia and decreased social pleasure were significantly associated with greater levels of loneliness (LiCQ), depression (BDI-II), and ASD symptoms (AQ). In DEP, increased social anhedonia was significantly associated with increased loneliness and depressive symptoms, and marginally significantly associated with increased ASD symptoms.
The integrity of the associations between social interest/anhedonia and loneliness was further explored when controlling for AQ and BDI-II scores in a multiple linear regression framework that is statistically equivalent to the assessment of partial correlations, where either AQ or BDI-II was added as a covariate. The TDC and DEP groups were collapsed into one TD group with greater variability in social motivation measures and depressive symptoms. When controlling for AQ across groups, increased RSAS and decreased ACIPS remained significant predictors of loneliness, except for the nonsignificant association between ACIPS and loneliness in ASD. When controlling for BDI-II scores, RSAS and ACIPS no longer significantly predicted loneliness, except for a marginally significant association between ACIPS and loneliness in the TD group (Figure 1).
Conclusions: Results indicate that decreased social interest and increased anhedonia are both associated with loneliness in TD and ASD adults. However, preliminary findings suggest that depressive symptoms, not ASD traits, in ASD and TD account for self-reported loneliness over and above measures of social interest/anhedonia.

180 **126.180** Repetitive Cognition Mediates the Relationship Between Autism Symptoms and Depression

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Background:
In typically-developing (TD) populations, repetitive cognition (e.g., rumination) often correlates with internalizing psychopathologies (Nolen-Hoeksema, 2000). In individuals with autism spectrum disorder (ASD), depression is similarly associated with rumination (Gotham et al., 2014), and there is an increased prevalence of depression in ASD (Buck et al., 2014).
Rumination has likewise shown correlations with some types of repetitive behavior seen in ASD, specifically those related to rigidity/insistence on sameness factor (Carcani-Rathwell et al., 2006; Gotham et al., 2014). Individuals with ASD exhibit a higher prevalence of rumination than TD peers (Crane et al., 2013).
It is unknown whether other forms of repetitive cognition seen in ASD (rigidity, fixation on interests, etc) are associated with increased depression risk or risk for other internalizing constructs, such as rejection sensitivity (an anxious preoccupation with expected rejection; Downey & Feldman, 1996); while these repetitive cognitions may be developmentally distinct from rumination as seen in TD peers, they may function similarly to predispose an individual to depression.
Objectives:
The present study aims to investigate whether increased levels of repetitive cognition may explain increased levels of a) depression and b) rejection sensitivity seen in individuals with more ASD symptoms.
Methods:
200 typically-developing adults were recruited through an online subject pool of university undergraduates. The following measures were used to assess our hypotheses: The Autism Quotient (AQ; Baron-Cohen et al., 2001), the Perseverative Thinking Questionnaire (PTQ; Ehring et al., 2011) and Rumination Response Scale (RRS; Treynor et al., 2003), the Patient Health Questionnaire – 9 item version (PHQ-9; Kroenke et al., 2001), and the Rejection Sensitivity Questionnaire (RSQ; Downey & Feldman, 1996).
Results:
There was a positive association between AQ and PHQ-9 (b = .26, p < .001) as well as AQ and PTQ (b = .32, p < .001) and RSQ (b = .39, p < .001). A model assessing PTQ as a mediator between AQ and PHQ-9 had a significant indirect effect (b = .18, 95% CI [.09, .28]). The direct effect of AQ on PHQ-9 after taking the mediator into account was nonsignificant (b = .07, p = .18), consistent with full mediation. Effect size was medium (κ^2 = .13, 95% CI [.03, .23]). Another model assessing PTQ as a mediator between AQ and RSQ was similarly supported with a significant indirect effect (b = .14, 95% CI [.07, .24]).
Conclusions:
A positive association was found between ASD symptoms and depression, which was at least partially explained by increased perseveration. Similarly, perseveration partially explained the relationship between ASD symptoms and rejection sensitivity. These findings support the use of cognitive approaches, such as cognitive-behavioral and mindfulness therapies, for treating depression in ASD, given their explicit focus on addressing repetitive thinking and other maladaptive cognitions (Anderson & Morris, 2006; Spek et al., 2012). Relatedly, these findings may indicate that repetitive cognition is a cognitive factor underpinning increased depression risk in ASD. Further research should clarify the role of increased perseveration in the development of internalizing psychopathologies in individuals with ASD.

181 **126.181** Risk and Protection Factors of Comorbidities in Pediatric Cohort with ASD: Elena Cohort

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Background: Medical conditions are more prevalent in youth with ASD than in the general population. These conditions are often related to the occurrence of aberrant behaviors, under-diagnosed and not taken into account for prevention.
Objectives: This study aimed to better estimate the prevalence and risk factors of comorbidities in ASD among children and adolescents.
Methods: ELENA cohort is a French prospective and multicenter study. Participants aged between 2 and 16 years, have a diagnosis of ASD formally established by multidisciplinary assessment according to ADOS, ADI and international criteria (ICD10/DSMV). Medical conditions are collected using an exhaustive and standardized parental questionnaire adapted from NIMH* and psychiatric symptoms using the CBCL.
Results: Our data focused on a subset of 400 participants. The most frequent prenatal medical conditions during are: maternal infection treated by antibiotics (17.6%), high maternal blood pressure (8%) and drug exposure (40%). The most frequent post-natal medical conditions are: gastrointestinal diseases (31.8 %), dermatological diseases (29.9%) and neurological disorders (29.5%). About 38% of children are under medical treatment. According to the CBCL6-18 years, 66% of participants exhibit psychiatric internalizing symptoms and 42% of externalizing problems: 51% of anxiety problems, 49% of affective problems, 19% of oppositional defiant problems, 14% of hyperactivity and attention deficit problems, 7% of conduct problems and 5% of somatic problems. The links between the occurrence of these conditions and several clinical or psychosocial variables are examined in order to find risk or protection factors.
Conclusions: These results confirmed the high frequency of medical conditions and comorbid symptoms in pediatric population with an ASD. These comorbidities are linked with clinical and psychosocial and they have to be better identified and early treated to prevent their negative impact on outcome trajectories. This will contribute to improve the quality of life of the whole family.

182 **126.182** Schizotypal Personality Traits in Autism Spectrum Disorders: What Are the Roles of Alexithymia and Anxiety?

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Background: There is a large diagnostic overlap between autism spectrum disorders (ASD) and schizotypal personality disorder (SPD). In particular, characteristics associated with increased ASD traits have been linked with increased negative symptoms, social skills deficits, and disorganized behavior in SPD. In addition, the presence of anxiety can be identified in both ASD and SPD at high rates of prevalence. Alexithymia (a difficulty identifying internal emotional states) is often found among those suffering from anxiety in the general population and is associated with ASD and SPD traits. Furthermore, it is an influential moderator of the relationship between ASD traits and anxiety and is associated with anxiety in schizophrenia. Despite these suggested associations, the nature of this overlap is unknown but a better understanding of it could aid discrimination in differential diagnosis and inform intervention selection and design. While it has been shown that the overlap between ASD and SPD traits is not due to anxiety, it is possible that this overlap is explained not by anxiety per se but by alexithymia.
Objectives: We examined the relationship between ASD and SPD traits in adults with ASD, and the roles of alexithymia and anxiety in this relationship, using structural equation modeling (SEM).
Methods: A combined UK-US sample of 75 adults with a confirmed diagnosis of ASD completed self-report questionnaires. ASD traits were identified using the Autism Spectrum Quotient (AQ), SPD traits were identified using the Schizotypal Personality Questionnaire (SPQ), and alexithymia was assessed by means of the Toronto Alexithymia Scale—20 (TAS-20). Anxiety was a latent variable constructed using the Penn State Worry Questionnaire (PSWQ), the Trait form of the State Trait Anxiety Inventory—Form Y (STAI-T Form-Y), and the Fear of Negative Evaluation Scale—Brief (FNE Brief).
Results: The SEM analysis supported the hypothesis that alexithymia plays an important role in the relationship between ASD traits and SPD traits. All factor loadings were in the expected direction and there was converging evidence for excellent model fit. Simple relationships (ASD traits to SPD traits and ASD traits to anxiety) were significant when modeled individually but these were eliminated by adding alexithymia as a mediator (ASD traits to SPD traits; 89.4% of the influence) and reduced by adding SPD traits as a mediator (ASD traits to anxiety; 38.9% of the influence). In the combined model, ASD traits did not directly predict anxiety when controlling for alexithymia and SPD traits nor did they directly predict SPD traits. However, increased ASD traits did predict increased alexithymia and alexithymia predicted SPD traits. Increased SPD traits predicted increased anxiety but increased alexithymia did not.
Conclusions: Alexithymia and SPD traits both served as mediators for their respective relationships, albeit to differing degrees. These results suggest that the presence of SPD traits in individuals with ASD is largely explained by alexithymia symptoms and not the ASD traits themselves.

183 **126.183** Self-Reported Suicidal Ideation, Depression and Loneliness in Adults with Autism Spectrum Disorder (ASD)

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Background: Previous studies report an exceptionally high rate of suicidal ideation (30 - 66%), plans or attempts at suicide (15 - 35%), and depression (31 - 70%), in adults with ASD, when compared to the general population (Balfe & Tantam, 2010; Cassidy et al., 2014; Raja, Azzoni, & Frustaci, 2011; Takara & Kondo, 2014). Depression is a significant risk factor for suicide, with symptoms present in at least 90% of individuals who die by suicide (Barraclough, Bunch, Nelson, & Sainsbury, 1974). However, studies on depression in ASD, and suicidal ideation in particular, are sparse and often anecdotal (Cassidy et al., 2014). Furthermore, adults with ASD may experience high rates of isolation and loneliness, both of which are associated with increased rates of depression (Mazurek, 2013), which may add to suicide risk.
Objectives: Our aim was to report and examine the relationship between self-reported depressive symptoms, suicidal ideation and loneliness in adults with ASD.
Methods: Participants were 76 adults (88% male) with ASD aged 17 to 56 years (M = 25.15, SD = 7.74 years) who were participating in a longitudinal employment study. Participants completed the Patient Health Questionnaire-9 (PHQ-9; Kroenke, Spitzer, & Williams, 2001), which includes a question concerning suicidal ideation, and the University of California Los Angeles Loneliness Scale (Russell, 1996; Russell, Peplau, & Cutrona, 1980; Russell, Peplau, & Ferguson, 1978). We report frequency of depressive symptoms (excluding ideation), ideation, and loneliness, and utilized correlation and mediation analysis (Hayes, 2013) to examine the relationship between these variables.
Results: Overall, 19.7% of the sample reported that they had experienced recent (last 2 weeks) thoughts that they would be better off dead, or of hurting themselves on several days (15.8%), more than half the days (1.3%), and nearly every day (2.6%). In terms of depressive symptoms, 25% of the sample were in the moderate to moderate-severe range, and 1.3% were in the severe range. Loneliness was significantly correlated with depressive symptoms (excluding ideation), r_s = .44, p < .001, but bore only a weak relationship with suicidal ideation, r_s = .29, p = .012. There was a significant indirect effect of loneliness on suicidal ideation through depression, b = .01; BCa CI [.004, .02], standardized effect size = .21; BCa CI [.10, .34].
Conclusions: Both the rates of suicidal ideation (19.7%) and at least moderate rates of depression (26.3%) were lower than those reported previously in adults with ASD. This difference may be accounted for by differences in methodology and sampling compared to previous studies which have, for example, used clinical interviews to ascertain ideation and history of suicide attempts in clinical groups (e.g., Cassidy et al., 2014). Nonetheless, these rates remain substantially higher than that for the general population, which are 3.7% and 6.2% for suicidal ideation and depression respectively (Crosby, Han, Ortega, Parks, & Gfroerer, 2011; Tiller, 2012). Importantly, we characterised the relationship between depression, loneliness and suicidal ideation, showing that depression mediated the relationship between loneliness and suicidal ideation.

184 **126.184** Simons Simplex Collection at the Interactive Autism Network: An Online Follow-up Study

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Background: The Simons Simplex Collection at the Interactive Autism Network (SSC@IAN) is an online cohort of families from the original SSC study who have agreed to be contacted about additional research opportunities. Participants in the SSC@IAN are members of simplex families, each of which has one child affected with an autism spectrum disorder, and unaffected parents and siblings. The online research environment at the SSC@IAN affords a unique, centralized platform to follow up with SSC families from all over the United States and Canada.
Objectives: The SSC@IAN follow-up study was an online study to gather medical, educational, diagnostic, and psychosocial updates on SSC probands and their families 5 to 8 years following their participation in the original SSC study. The original SSC cohort is a clinically and genetically well-characterized cohort that has proven valuable for research, and the follow-up study aimed to provide researchers with updated data on as many families as possible.
Methods: SSC@IAN families were provided the opportunity to complete 3 modules, accessible via their online research dashboard. Each module included a selection of update surveys (e.g. medical, pharmacological/treatment, educational, and diagnostic history) and standardized measures such as the Social Responsiveness Scale – Second Edition, Adult Behavior Checklist or Child Behavior Checklist, Aberrant Behavior Checklist, and Repetitive Behavior Scale-Revised.
Results: Four hundred (400) families with probands under age 18 completed some portion of the follow-up study. Ratios of males to females and IQ, are comparable between the original SSC cohort and the follow up participants. Mean full scale IQ for the original SSC cohort was 81, verbal IQ was 78 and nonverbal IQ was 84; for the follow-up study, the full scale IQ was 83, verbal IQ was 80, and non-verbal IQ was 86.Â Age ranged from 4 to 17 for the complete original SSC cohort (mean 9.0 years), and 8 to 17 years of age for the follow-up study cohort (mean 12.9 years).Â The age at baseline assessment in the present follow-up cohort was 4 to 11 years. Compared to the baseline SSC cohort data, probands showed lower scores in some specific areas, including RBS-R repetitive and sensory behaviors (total mean 27.0, 21.7), and CBCL6-18 externalizing behaviors (T mean 56.2, 52.7).Â Internalizing behavior and ADHD scores were similar between the follow-up study and baseline SSC cohort data (Internalizing T mean 60.0, 60.1; ADHD T mean 61.9, 60.6).Â In terms of comorbid diagnoses, parents reported high frequencies of diagnosis or treatment for ADHD (42%) and anxiety (26%) in probands at follow-up, with lower frequencies of seizure (6%), depression (4%), and bipolar disorders (2.5%).
Conclusions: The SSC@IAN follow-up study provides additional longitudinal data for researchers to investigate outcomes in this well-characterized ASD cohort.Â In general, the current sample shows a trend towards lower scores on some ASD and related behavioral measures compared with the SSC cohort's original data, suggesting milder symptoms. However, consistent with other studies, anxiety disorders and ADHD are common comorbid conditions now reported in these older children and teens with ASD.

185 **126.185** Specific Medical Conditions Are Associated with Unique Behavioral Profiles in Autism Spectrum Disorders

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Background:
Autism spectrum disorder (ASD) is a heterogeneous group of disorders which occurs with numerous medical conditions. In previous research, subtyping in ASD has been based mostly on cognitive ability and ASD symptom severity. Several medical conditions have frequently been described as co-occurring with ASD. Research so far has not addressed the question of whether unique medical conditions occur in specific ASD subtypes. Medical phenotypes can potentially be used as biological variables to define specific endophenotypes in ASD.
Objectives:
The aim of the current study was to investigate whether specific medical conditions in ASD, including macrocephaly, microcephaly, developmental regression, food selectivity, and sleep problems are associated with unique behavioral profiles.
Methods:
The study population included 1,224 participants, 1043 males and 181 females (M:F ratio=5.8:1) with a mean age of 49.9m (SD=29.4) diagnosed with ASD. All the participants underwent comprehensive assessments, including medical history and neurological examination, cognitive and adaptive behavior evaluations, and ASD diagnostic tests. The behavioral profile was composed of cognitive ability, adaptive skills, and autism severity using the relevant standardized scores and was examined in each of the aforementioned medical conditions.
Results:
Groups with and without the defined medical conditions were compared on the behavioral measures. Developmental regression was present in 19% of the population and showed a more severe clinical presentation, with lower cognitive abilities, more severe ASD symptoms, and more impaired adaptive functioning. Microcephaly was observed in 6.3% of the population and was characterized by a lower cognitive ability and more impaired adaptive functioning in comparison to the normative head circumference (HC) group. Severe food selectivity was found in 9.8% and severe sleep problems in 5.1% of the ASD population. The food selectivity and sleep problem subgroups both showed more impaired adaptive skills, and more severe autism symptoms as described by the parents, but not per the professional assessment. Macrocephaly was observed in 7.9% of the ASD population and did not differ from the normative HC group in any of the examined behavioral measures.
Conclusions:
Based on these findings, two unique medical-behavioral subtypes in ASD that affect inherited traits of cognition and/or autism severity were suggested. The developmental regression phenotype occurred with widespread, more severe impairments in cognition, autism severity and adaptive skills, while the microcephaly phenotype occurred with more impaired cognition and adaptive skills. In contrast, severe food selectivity and sleep problems represent only comorbidities to ASD that affect functioning as manifested by lower adaptive skills. Defining specific subgroups in ASD with a unique biological signature and specific behavioral phenotypes may help future genetic and neuroscience research.

186 **126.186** Sustained Pupil Dilation to Sad Faces Is Associated with Self-Reported Rumination in Adults with Autism Spectrum Disorder and Adults with Current Depression

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Background: Rumination, or repetitive negative thinking, is associated with the onset and maintenance of depressive disorders in the typically developing (TD) population. Autism spectrum disorder (ASD) is marked by repetitive thinking and behaviors as one of the core symptom domains that characterize this disorder. Rates of depression are also notably high in adolescents and adults with ASD. Our long-term goal is to explore repetitive thinking as a pathway to depressed mood in ASD. However, we first must lay groundwork in understanding the measurement of and mechanisms associated with depressive rumination in this special population. Pupillometry offers a neural measure of *sustained*cognitive-affective processing, which may converge with repetitive thinking.
Objectives: The current work aims to advance understanding of how people with ASD, a population marked by repetitive thinking and high rates of depression, compare to typically developing depressed (DEP) and never-depressed controls (TDC) on measures of repetitive negative thinking and sustained neural response to social-emotional material. We assessed group differences among these three diagnostic cohorts on both self-reported rumination and on pupil indices of reflexive cognitive-affective response over time, and assessed whether rumination is related to affective response in general, and within ASD specifically.
Methods: A total of n=53 adults aged 18-35 with verbal IQ>80 were recruited from three cohorts: ASD (n=21); TD with current depressive disorders (DEP, n=13); and TD comparison participants with no depression or anxiety history (TDC, n=19). All participants completed diagnostic screening and testing (including the Autism Diagnostic Observation Schedule [ADOS-2] and the Structured Clinical Interview for DSM-5 Disorders [SCID-5]), self-reported on depressive rumination with the Ruminative Response Scale (RRS), and provided pupillary response data within a passive-viewing task in which emotionally-valenced faces were displayed for 400 ms, followed by an 8 second mask.
Results: Participants with ASD were significantly higher than TDC and significantly lower than DEP on depressive rumination (RRS). For pupil analyses, patterns of significant cohort differences preserved across stimulus condition (Happy, Sad, Angry, Neutral) suggest a more dynamic trajectory in ASD pupil response, in which ASD resembles TDC at second 2 and grows in magnitude of pupil dilation over the trial duration to more resemble DEP by second 8 -- whereas the two TD cohorts show an immediate response (either low or high) and sustain that level on average throughout trial duration (Figure 1). Individuals who ruminate more (here, they tended to belong to the ASD or DEP cohorts) generally had greater pupil dilation to Sad faces across 8 second trials (Figure 2). When TDC and DEP were collapsed into one TD group with greater variability on rumination, the interaction was also significant for Happy and marginally significant for Angry conditions.
Conclusions: These data suggest that both ASD and TD individuals who endorse ruminating also are likely to exhibit sustained neural activity following emotionally-salient information. This work helps to locate ASD on a continuum of rumination scores, and to evaluate the convergence between self-reported rumination and sustained neural response to emotional stimuli within and across these diagnostic cohorts.

187 **126.187** Testing the Psychometric Properties of the Spence Children's Anxiety Scale (SCAS) and the Screen for Child Anxiety Related Emotional Disorders (SCARED) in Autism Spectrum Disorder.

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Background:
There is a need to screen for anxiety in individuals with autism spectrum disorders (ASD) as it is one of the most prevalent co-occurring conditions (Simonoff et al., 2008) and individuals have reported these additional symptoms to be more impairing than their ASD symptoms. Questionnaires are most often used for screening for anxiety but have usually only been validated in typically developing populations. Study of the psychometric properties of such measures for use with ASD populations is limited.
Objectives:
To explore the psychometric properties of two commonly used questionnaires, the SCAS and the SCARED, with an ASD sample, in comparison to DSM-IV anxiety diagnoses according to the Child and Adolescent Psychiatric Assessment (CAPA).
Methods:
The study included 49 males (aged 10-16 years) with a clinical diagnosis of ASD. The SCAS (Spence, 1998) and SCARED (Birmaher et al., 1999) were completed by parents and children. Trained researchers also conducted the parent-version of the CAPA (Angold and Costello, 2000), a semi-structured psychiatric interview schedule.
Results:
Rate of comorbidities
Using the DSM-IV CAPA algorithms, 63% of participants with ASD met criteria for one or more anxiety diagnosis: the most common were generalised anxiety (39%) and panic disorder (27%).
Internal consistency
The internal consistency for the total scores on both measures was high for both parent-report (both; αÂ =0.95) and self-report (SCAS; αÂ =.92, SCARED; αÂ =.94). The internal consistency of the sub-scales was higher in the SCAS (parent αÂ =.65–.84; self-report αÂ =.69-.81) than the SCARED (parent αÂ =.47–.75; self-report αÂ =.46-.66) and in the parent report compared to the self-report.
Parent-child agreement
Parent and child scores were significantly correlated for both the SCAS (r =0.59, p <0.001) and the SCARED (r =0.46, p <0.001).
Comparison of the SCAS and the SCARED
The difference in the power of the two parent-report questionnaire measures in predicting an anxiety disorder was not significant when measured using ROC analyses ($X^2(1)$ =2.18, p =0.14) or between the two self-report measures ($X^2(1)$ =0.16, p =0.69).
Cut-points with parent data
In the ASD sample, using the recommended cut-off on the SCARED (25) gives 77.4% sensitivity and 50% specificity (67.4% correctly classified). ROC analyses in the ASD sample suggest an alternate cut-off of 28.5 to maximise both the sensitivity (74.2%) and specificity (72.2%), which would correctly classify 73.5% of the sample. The suggested cut-off for the parent SCAS (24) gives 87.1% sensitivity and 66.7% specificity (79.6% correctly classified). In this ASD sample, ROC analyses suggest a higher cut-off of 27.5 maximises both the sensitivity (77.4%) and specificity (77.8%), which would correctly classify 77.6% of the sample.
Conclusions:
There was no significant difference between the predictive power of the SCAS and the SCARED in an ASD sample; both questionnaires had good levels of sensitivity and specificity using cut-points validated in the typically developing population. Analyses indicate higher cut-points in ASD may be more accurate. This may reflect the symptom overlap in ASD and anxiety.

188 **126.188** The Children's Sleep Habits Questionnaire: Evaluating Subscales for Sleep Problems in Children with Autism Spectrum Disorder

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Background: Â Children with Autism Spectrum Disorder (ASD) face many developmental obstacles, including elevated sleep problems. To accurately identify these problems, psychometrically sound measures are important. The Children's Sleep Habits Questionnaire (CSHQ; Owens et al., 2000) is the most common measure of sleep problems in early childhood—including children with ASD. However, despite its common use, few studies have assessed the accuracy of the CSHQ in screening sleep problems in this population.
Objectives: Â We aimed to explore the basic psychometric properties of CSHQ subscales in a sample of children with ASD. We further aimed to determine whether these subscales were useful in screening pediatric sleep problems.
Methods: This study included 41 children with ASD between the ages of 2-10 (*M*= 5.5). Caregivers completed the CSHQ as part of a larger study of sleep and behavior in the context of early intervention. The CSHQ includes 33 parent-report items with eight empirically derived subscales (Owens et al. 2000). This measure was recently validated in children ages 2-5, resulting in five subscales for use in toddlers and pre-school aged children (CSHQ-T; Sneddon et al., 2013). Children were first grouped into 'sleep problem' and 'non-problem' categories via parent reports at time of enrollment (Does your child have a sleep problem?). Using data from published validation studies (Owens et al., 2000; Sneddon et al., 2013), mean subscale scores for the 'sleep problem' group were compared to a clinical sample, and mean subscale scores from the 'non-problem' group were compared to a community sample. Differences between samples were evaluated using Welch's *t* tests.
Results: Â Cronbach's alpha ranged from .64 to 1.00 for Owens' subscales, and .78 to 1.00 for the CSHQ-T. When comparing Owens' community sample with the 'non-problem' group, two subscales were significantly different ($p < .05$): Parasomnias and Daytime Sleepiness (Table 1). In this comparison, mean subscale scores were higher in the 'non-problem' group than the community sample. When comparing Owens' clinical sample with the 'sleep problem' group, only sleep duration was significantly different ($p < .01$). Duration difficulties (mean scores) were higher in our 'sleep problem' group than the clinical sample (Table 1). Finally, two subscales differed significantly when comparing the CSHQ-T community sample and the 'non-problem' group, with higher mean scores in the 'non-problem' group. However, there were no significant differences between our 'sleep problem' group and the clinical sample (Table 2).
Conclusions: This work contributes to a growing body of literature on sleep problems in children with ASD.Â Specifically, this is the first known study to explore basic psychometric properties of the CSHQ-T in a sample of children with ASD, including statistical comparisons with published clinical and community samples. Overall, both sets of subscales had acceptable psychometric properties and accurately distinguished between problem and non-problem sleepers in our sample. Significantly higher scores for children in the 'non-problem' group compared to community samples may reflect under-reporting of ASD sleep problems at time of enrollment. Future directions include validating the CSHQ-T with a larger, representative sample of children with ASD.

189 **126.189** The Gender Development Scale: Screening for Gender Dysphoria or Incongruence in Youth with ASD

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Background: An overrepresentation of ASD among individuals with gender dysphoria (GD) has been reported, with rates of almost 1 in 10 youth diagnosed with GD meeting full diagnostic criteria for ASD, and many others presenting with the broader ASD phenotype (de Vries et al., 2010). There is also evidence that gender-related concerns are more common among youth with ASD (Strang et al., 2014; Janssen et al., 2016). Initial clinical guidelines for supporting individuals with co-occurring ASD and GD have been developed (Strang et al., 2016), but there are no established screening methods for assessing GD in individuals with ASD. The Gender Development Scale (GDS; Strang et al., 2016) includes not only a self- and parent-report measure assessing current presentation of gender identity and gender dysphoria, but also retrospective parent-report of children's gender presentation prior to puberty (age 4-8) to assess pre-pubertal (historical) signs of GD.
Objectives: Evaluate critical items from the self-report and parent-report versions of the GDS in cis-gender neurotypical (NT) youth, cis-gender youth with ASD without intellectual disability (ID), and gender dysphoric youth with ASD without ID. In youth with GD and ASD, evaluate pre-pubertal history, as reported by the parent, for signs of GD or gender variance.
Methods: Fifty-two youth (age 7-19) and their parents completed items from the GDS (26 cis-gender NT, 16 cis-gender with ASD, 10 gender dysphoric with ASD). Parents completed additional GDS items assessing gender characteristics prior to puberty (age 4-8).
Results: Three critical items assessing gender congruence/dysphoria showed 96.4% accuracy in categorizing youth according to GD vs. cis-gender status, with 99.14% accuracy for the self-report version alone. Among individuals with ASD and GD, there were no endorsements of gender non-binary identity (i.e., being both male and female) or agender identity (i.e., being neither male nor female), though one GD individual wished for a body that was neither male nor female. Parent-report from pre-puberty among individuals with GD and ASD indicated few signs of GD or gender nonconformity prior to puberty. Nineteen percent of youth in this study endorsed a strong wish for their body to stay a child's body and not become a grown-up body, with no differences in rates of endorsement between cis-gender NT, cis-gender ASD, and gender dysphoric ASD groups ($\chi^2(2)=0.77$, $p=.69$).
Conclusions: This study found that critical items from both the self- and parent-report of a gender questionnaire (The Gender Development Scale) accurately classified GD vs. cis-gender status in youth with ASD without ID, as well as among cis-gender NT. This establishes preliminary validity for this assessment method. Gender presentation as reported by parents prior to puberty was negative for signs of GD or gender nonconformity, adding support to clinical observations that GD youth with ASD tend to present gender concerns later in development. Future studies should explore why GD presents later in development in ASD.

190 **126.190** The Relationship Between Group Belonging, Subclinical Autistic Traits and Mental Health

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Background:
There is evidence that depression and anxiety is elevated in young adults with high levels of subclinical autistic traits (Kanne et al., 2009). Furthermore, identifying with multiple groups (e.g. family, local community and social groups) predicts lower levels of anxiety and depression in adults in the general population (Sani et al., 2015). Individuals with ASD experience difficulties with communication and social interaction, which may impact on forming relationships with other people. They also experience elevated levels of mental ill health (Simonoff et al., 2009). Therefore, it is anticipated that subclinical autistic traits and group belonging are predictive of symptoms of generalised anxiety and depression.
Objectives:
It was hypothesised that:

- People who report identifying with fewer groups (either zero or one) will have more autistic traits than people who report identifying with more groups (either two or three).
- Group identification and autistic traits will significantly predict generalised anxiety symptoms and depression symptoms.Â Gender and age were also included as predictor variables for both multiple regressions.

Methods:
The Autistic Spectrum Quotient (AQ; Baron-Cohen et al., 2001), Group Identification Scale (GIS: Sani et al., 2014), Generalised Anxiety Scale–7 (GAD-7; Spitzer et al., 2006) and Major Depression Inventory (MDI; Bech et al., 2001) were administered to 171 individuals. Data from 149 participants (Female: 69.8%; Male: 30.2%) were analysed after exclusion criteria (i.e. missing more than one item per measure) were applied.Â AQ scores ranged from 3 to 45 (M = 17.16; SD = 8.37) and number of groups identified with ranged from 0 to 3 (M = 1.85; SD = 0.898).
Results:
The autistic traits of people with high group identification (2 or 3 groups) were compared to individuals with low group identification (0 or 1 group). The low group-belonging group had significantly higher autistic traits (M: 23.64; SD: 10.19) than those in the high group (M: 14.54; 5.76), t(147) = 6.891, p<.001.
GAD-7: The overall model demonstrated that age, gender, autistic traits and group identification statistically significantly predicted generalised anxiety symptoms, $F(4,144) = 15.741$, $p < .001$, R^2Adj. = .285.
MDI: The overall model demonstrated that age, gender, autistic traits and group identification statistically significantly predicted depression symptoms, $F(4,144) = 13.970$, $p < .001$, R^2Adj. = .260.
Conclusions:
Autistic traits and group belonging significantly predict generalised anxiety scores and depression scores in adults in the general population. Furthermore, individuals with low levels of group belonging had significantly more autistic traits than those with high group belonging. Higher levels of group belonging are related to both better physical health (Sani et al., 2014) and mental health (Sani et al., 2012) outcomes. Based on the results from this study, we suggest it would be beneficial to explore group belonging in individuals with diagnosed ASD, in order to determine whether it is predictive of mental health outcomes. If found to be the case, there are important clinical implications (e.g. for interventions to manage depression and anxiety) that should be explored.

191 **126.191** Traditional and Distinct Symptoms of Anxiety in Youth with ASD and a Broad Range of Intellectual Functioning

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Background:
Research suggests that youth with ASD present with both DSM-defined –hereon called "traditional"– anxiety disorders (e.g. specific phobia, generalized, separation, and social anxiety) and also more idiosyncratic –hereon called "distinct"– manifestations of anxiety, such as fears of change, anxiety around social rules/unpredictability and unusual phobias (e.g. fears of men with beards, toilets, sounds). Distinct symptoms share many qualities with traditionally-defined anxiety disorders (e.g. anticipatory worry, avoidance, physiological arousal), but do not fit DSM-defined anxiety categories and have historically been viewed as associated symptoms of ASD. The lack of clarity about where autism stops and anxiety begins contributes to variability in measurement and impedes progress in research. Furthermore, distinct anxiety may be particularly prone to being overshadowed by ASD, potentially reducing access to appropriate behavioral and cognitive-behavioral treatments.
Objectives:
The present study aimed to examine the rate and quality of traditional and distinct anxiety in a cohort of children with ASD and highly varied IQ. We also explored concordance between brief questionnaires and a gold-standard clinical interview for traditional and distinct anxiety.
Methods:
A preliminary sample of 24 youth (*N*=35 anticipated by 05/2017) with ASD (ages 9–15 years: *M*=11.96,SD=1.12; 70% male; 33% with IQ<70 (range: 31 - 170) were recruited as part of a longitudinal study of biological and behavioral correlates of ASD. Participants were enrolled at age 2-3.5 with follow-up assessment at 9-13 years (ongoing). Anxiety symptoms were assessed at follow-up via the Anxiety Disorders Interview Schedule–Parent/Autism Spectrum Addendum (ADIS/ASA), a gold standard clinical interview validated to assess traditional and distinct anxiety in ASD, the Child Behavior Checklist (CBCL), the Manifest Anxiety Scale for Children (MASC), and the Screen for Anxiety and Related Disorders (SCARED). ADIS/ASA Clinician Severity Ratings (CSRs; Range 0-8; CSR≥ 4 clinical cut-off for diagnosis/significant impairment) reflect anxiety-related impairment for traditional and distinct anxiety. The highest traditional and distinct CSRs were used to categorize each child's anxiety presentation and assess concordance with brief measures.
Results:
Per the ADIS/ASA, 71% of children presented with clinical anxiety (CSR ≥ 4), including: 21% traditional anxiety, 21% distinct anxiety, 29% both. Clinical anxiety was as common in youth with and without ID, but there was a trend for youth with ID to have less traditional anxiety (X^2 = 3.00, *p*=.08). Whereas the highest traditional anxiety CSR was correlated with SCARED (*r*=.57, *p*=.01), MASC (*r*=.67, p<.01), and CBCL Anxious/Depressed totals (*r*=.57, *p*=.01), distinct CSRs were not (*r*=-.14, .04 and .02 respectively). Exploratory analyses revealed that brief measures appeared more sensitive to DSM-anxiety in youth, but did flag anxiety in some youth with only distinct presentations (Table 1).
Conclusions:
This study illustrates the presentation of traditional and distinct anxiety in youth with ASD and a broad range of intellectual functioning. It suggests that brief measures detect traditional anxiety better than distinct symptoms and may fall particularly short for youth with ID. Anxiety may be particularly likely to be missed in youth with ASD when the content of their worries/fears varies from traditional conceptualizations or when their cognitive abilities are impaired.

192 **126.192** Predicting Parent-Reported Sleep Problems Using Longitudinal Data and Machine Learning Methods in the Autism Speaks-Autism Treatment Network Registry

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Background: Sleep difficulties in children with Autism Spectrum Disorder (ASD) have been well established, and studies indicate that 50 to 80% of children with ASD have sleep problems (Richdale, 1999; Polimeni, et al, 2005; Courturier, et al, 2005; Krakowiak, et al, 2008). Of the children in the Autism Speaks-Autism Treatment Network (ATN) registry who do not have any parent-reported sleep problems at baseline (58%), a substantial subset have sleep problems reported at first follow-up (20.5%). Developing a predictive model for parent-reported sleep problems using longitudinal data and machine learning could help with treatment and prevention of these problems.
Objectives: To develop a model to predict sleep problems at first follow-up from baseline characteristics among children with no sleep problems at baseline.
Methods: A sample of children in the ATN registry without parent-reported sleep problems at baseline and with complete sleep data at first follow-up was randomly split into training and test samples, stratified by ATN site and age group. Children taking medications indicated for sleep at baseline or follow-up were excluded. Training sample baseline characteristics, including demographics, IQ, psychiatric diagnoses, health problems, and autism severity, behavior, and sensory scores, were tested for associations with subsequent sleep problems. Predictors were chosen based on statistical significance and clinical importance, correlation and multicollinearity considerations, and comparison of c-statistics from alternative logistic regression models. Given probabilities of sleep problems from the final model, a threshold for classifying children as at risk was selected that yielded at least 85% sensitivity and maintained maximum associated specificity. Each child in the test sample was then scored and assigned a predicted sleep problem status based on the model threshold. Comparison of the predicted and true sleep problem status of the test sample yielded sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy.
Results: In the training sample (n=527), children with less educated parents (28.0% vs. 15.9%, p=0.007), ear, nose, and throat (ENT) problems (27.4% vs. 14.6%, p=0.028), asthma (37.5% vs. 16.5%, p=0.023), higher Child Behavior Checklist (CBCL) Anxious/Depressed and Aggressive Behavior z-scores (0.0 vs. -0.3 for each, p=0.031 and p=0.029, respectively) have more sleep problems. In the final model using these predictors, aggressive behavior remains independently associated with higher odds of having sleep problems at first follow-up (OR 1.66, 95% CI 1.07-2.58, p=0.024), and having asthma is associated with higher odds but with borderline significance (OR 2.71, 95% CI 1.00-7.33, p=0.050). This model performed in the test sample (n=518) with sensitivity 80.3%, specificity 33.4%, PPV 18.5%, NPV 90.0%, and accuracy 40.9%.
Conclusions: Among children with ASD, those with more aggressive behavior, asthma, ENT problems, anxious/depressed behavior, and less educated parents at baseline may present with more sleep problems at first follow-up. In a multivariable model aggressive behavior independently predicts sleep problems. The multivariable model, with high sensitivity for identifying children at risk for sleep problems as well as accurate prediction of low risk of sleep problems, can help with treatment and prevention of sleep problems. Further data collection may provide better prediction through methods requiring larger samples.

193 **126.193** Predicting Insomnia in Young Adults: The Role of Autism Symptom Severity, Sensory Atypicality and Intolerance of Uncertainty.

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Background: Poor sleep, primarily insomnia symptoms, is highly prevalent in autism across the lifespan and has a significant negative impact on all aspects of functioning, often over and above core autism symptoms. Therefore, insomnia constitutes an important treatment target, however, factors underlying insomnia problems in autism are currently poorly understood. Both autism symptom severity and atypical sensory behaviour are related to poor sleep. Intolerance of uncertainty is a trans-diagnostic risk factor predisposing individuals with and without autism to experience higher levels of stress and anxiety, and might therefore be related to insomnia problems. However, its role in ASD has not been previously explored.
Objectives: To examine the role of autism symptom severity (ASS), sensory seeking behaviour (SSB) and intolerance of uncertainty (IU) in predicting insomnia symptoms in young adults with and without autism.
Methods: Participants enrolled in the Autism CRC School Leavers longitudinal study completed online questionnaires on ASS (Autism Quotient [AQ]-28), SSB (Repetitive Behaviour Questionnaire [RBQ]-2A-SSB), depression (Patient Health Questionnaire-9), anxiety (DSM-5- Dimensional Anxiety Scales: Generalized Anxiety), IU (Intolerance of Uncertainty Scale [IUS]-12) and sleep (Pittsburgh Sleep Quality Questionnaire [PSQI]). There were 53 young adults (M_{age}=18.39 years, SD=2.44; 56.6% male) with 65.4% (N=52) reporting an autism spectrum diagnosis; those with a diagnosis (M_{AQ-28} = 76.79, SD=10.92; 73.5% male) had a significantly higher AQ-28 score (P<.001) than the non-autism group (M_{AQ-28}= 58.83, SD=14.15).
Results: 56.6% (N=53) of individuals had a sleep problem (PSQI>5), including 55.9% of those with, and 61.1% of those without autism (χ^2 (1, N=52) = .005, P=.946). Neither age nor gender were significantly associated with SSB (P=.707; P=.788), IU (P=.785, P=.743), PSQI (P=.721, P=.205), anxiety (P=.396, P=.127) or depression (P=.855, P=.633), respectively. Consistent with more males with autism, the AQ-28 score was significantly associated with gender (P=.039), but not age (P=.673). Depression and anxiety scores were all moderately or strongly and significantly associated with ASS, SSB and IU. A hierarchical regression predicting insomnia (PSQI score) was conducted, with scores for AQ-28 entered at Step 1, RBQ-2A-SSB entered at Step 2, and IUS-12 entered at Step 3. The final model was significant F (3,49) = 7.059, P<.001, R^2=30.2 % of variance in sleep accounted for (adjusted R^2=25.9%). At Step 1 (AQ-28) ΔR^2=12.8% (P=.009), at Step 2 (RBQ2A-SSB) ΔR^2=9.1% (P=.019), and at Step 3 (IU-12) ΔR^2=8.3% (P=.020); IU was a significant unique predictor of insomnia (β=.349; P=.020) in the final model.
Conclusions: Autism symptom severity, sensory atypicality and intolerance of uncertainty together accounted for 30% of variance in insomnia scores, with intolerance of uncertainty being an independent predictor. This supports increased autism symptoms and intolerance of uncertainty as risk factors for insomnia. Our study thus provides the first evidence pointing to the trans-diagnostic factor, intolerance of uncertainty, which underlies susceptibility to anxiety and depression, as a potential key factor in the development of insomnia in autism. Further exploration, including models with anxiety and depression, is indicated to understand how insomnia develops in autism, thus informing the development of both prevention and treatment approaches for insomnia across the lifespan.

194 **126.194** Employment Status Is Related to Sleep Problems in Adults with Autism Spectrum Disorder

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Background: Sleep problems are commonly reported for individuals with Autism Spectrum Disorder (ASD). While insomnia symptoms are the most frequently reported problems, there is emerging evidence that the timing of sleep is also atypical, with circadian rhythm sleep-wake disorders (CRSWDs) also reported for some individuals with ASD. Research also demonstrates a distinct sub-group of individuals who do not have sleep problems. However, there is very little research that has investigated factors that may be associated with the presence or absence of sleep problems in those with ASD. Comorbid diagnoses of psychopathology disorders (anxiety and depression) as well as employment outcomes may be associated with the presence of sleep problems in adults with ASD. Gaining an understanding of factors that are associated with and without sleep problems, will assist in the development of appropriate prevention and treatment techniques.
Objectives: The aim of this study was to explore factors that may be associated with the presence and absence of an ICSD-3 defined sleep problem in adults with ASD and no comorbid intellectual impairment.
Methods: 36 adults with ASD (47.2% male; M_{age} = 34.41 years, *SD*= 6.52) completed a 14-day sleep-wake diary and 14 day actigraphy assessment. All participants had an IQ > 80. Fifteen participants were medicated for a comorbid diagnosis of anxiety and/or depression. Participants also completed a questionnaire battery including the Pittsburgh Sleep Quality Index (PSQI), the State-Trait Anxiety Inventory (STAI), the Patient Health Questionnaire (PHQ-8; depression scale) and a demographic questionnaire.
Results: Based on 14-day sleep-wake diary and actigraphy assessment four adults with ASD met criteria for insomnia, 10 for a CRSWD and six met criteria for both. Demographic variables including FSIQ, age and gender did not differentiate the two groups of adults (Table 1). Consistent with the presence of sleep problems, PSQI scores were higher in the Sleep Problem group. The groups did not differ on their scores on the STAI (t = -0.998, p = .325) and PHQ-8 (t = .019, p = .985). Likewise, there were no differences in the proportion of individuals in each group who were medicated for comorbid diagnoses of anxiety and depression (χ^2 = .630, p = .427). The Sleep Problem group were more likely to be unemployed compared to adults with no sleep problem (χ^2 = 12.963, p < .001). In particular, all nine adults who were unemployed met criteria for a sleep problem.
Conclusions: Employment outcomes are frequently reported to be poor in adults with ASD. These poor outcomes have typically been associated with the social deficits those with ASD experience. The findings of this study demonstrate for the first time that sleep problems are associated with unemployment, however the direction of this relationship is unclear. It is possible that sleep problems, particularly CRSWDs that have developed during adolescence make attainment and maintenance of employment for those with ASD difficult, or that a lack of employment results in less restrictions required for optimal and appropriate sleep timing. Longitudinal studies would be beneficial to further explore this relationship.

195 **126.195** Parent-Based Sleep Education in Autism: A Community-Academic Research Partnership

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Background: Sleep disturbance affects 50-80% of children with autism spectrum disorder (ASD). Behavioral sleep education for children with sleep disturbance is currently provided largely within academic medical centers, which often include long waiting lists for this service.
Objectives: Our study aims to determine the feasibility of providing sleep education training to parents of children with ASD in diverse community settings in relation to more traditional university-based settings.
Methods: We included three Middle Tennessee pediatric practices in this study—Mercy Community Healthcare, Rivergate Pediatrics, and Goodlettsville Pediatrics, along with community therapists. The following elements comprised our study: (1) Recruitment and consent of participating families, as well as instruction in study procedures such as actigraphy; (2) Collection of baseline data; (3) Therapist training and fidelity; (4) Delivery of sleep education to families; and (5) Collection of intervention data.
Our sleep education curriculum was delivered in one 60-90 minute session with 2 follow-up sessions and covered appropriate sleep habits, including construction of an individualized bedtime routine and optimization of parent-child interactions. Paired t-tests were used to compare data pre and post intervention. We used on-line surveys through Research Electronic Data Capture (REDCap) to reduce family burden.
Results: Â Recruitment for our study is on target, with families expressing support for having study procedures done at their pediatricians' office, rather than driving to the medical center. All of our therapists reached fidelity on mock sessions and actual parent education sessions. To date, 21 families have participated with 16 completing baseline and intervention data. Children with ASD had a mean (standard deviation) age of 7.0 (2.9) years. Improvements were noted in the following Children's Sleep Habits Questionnaire (CSHQ) subscales: sleep onset delay (p=0.000), bedtime resistance (p=0.001), sleep duration (p=0.000), night wakings (p=0.048), and parasomnias (p=0.030). CSHQ subscales in sleep anxiety (p=0.226), sleep disordered breathing (p=0.382), and daytime sleepiness (p=0.257) did not show improvement. The Family Inventory of Sleep Habits (FISH) also improved (p=0.002). Actigraphy measures showed improvement in sleep onset delay with a mean of 38.6 (18.4) minutes pre- intervention and 33.3 (21.4) post- intervention, but did not reach significance (p = 0.313).
Conclusions: This study shows that sleep education typically housed within specialized medical settings can be extended to community practitioners with minimal to no background in sleep, allowing families to receive behavioral sleep education in familiar locations as part of their ongoing care and with potentially shorter wait times. Partnering with community practitioners to deliver such education to families provides an opportunity to broaden access to sleep therapeutics in the community, while forging collaborations between sleep medicine physicians, primary care providers, and community therapists.

196 **126.196** Effects of Social Skills on Anxiety and Parasympathetic Activity Among Youth with Autism Across the PEERS® Intervention

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Background: Improving social skills is likely to lead to decreases in anxiety symptoms, especially social anxiety, for adolescents with ASD (Bellini, 2006). In particular, the PEERS®intervention demonstrates such an effect, via self- and parent-report (Schohl et al., 2014). Neither longer-term outcomes for anxiety nor changes in arousal as a marker of anxiety have been previously examined.
Objectives: To determine if adolescents with ASD showed significant declines in self- and parent-report of anxiety and improvements in respiratory sinus arrhythmia (RSA) across three time points.
Methods: Thirty-nine adolescents with ASD (*N*=39) aged 11 to 16, IQ≥70 participated in this study. ASD was confirmed using the ADOS. Adolescents comprised the experimental group of a randomized controlled trial and received the Program for the Education and Enrichment of Relational Skills (PEERS®), which focuses on improving friendship quality and social skills among adolescents with ASD. Adolescents completed the Social Anxiety Scale for Adolescents (SAS-A), Youth Self-Report (YSR), and an eyes-open resting-state RSA paradigm (Porges & Bohrer, 1990). Parents/caregivers completed the Social Anxiety Scale for Adolescents, Parent (SAS-P) and the Child Behavior Checklist (CBCL). All data was collected pre-, post-, and six months following PEERS®.
Results: Pearson's correlations showed some evidence of a relationship between anxiety and RSA, but no consistent pattern across time points. Repeated Measures ANOVAs showed significant declines in self-report of social anxiety, SAS-A ($F(2, 76)=9.174$, $p<.001$), parent-report of social anxiety, SAS-P ($F(2, 64.34)=11.34$, $p<.001$), and parent-report of general anxiety, CBCL ($F(2, 32)=4.476$, $p=.019$), but not self-report of general anxiety, YSR ($p>.05$). Paradoxically, RSA significantly declined across the three time points ($F(2, 55.04)=8.875$, $p<.001$).
The sample was subsequently split into socially anxious (SA) and not (NSA) using the clinical cutoff for the SAS-P at pre-, and the ANOVAs were rerun. Results showed significant differences across time for the SA subgroup (SAS-A, ($F(2, 68)=8.35$, $p=.001$); SAS-P, ($F(2, 44)=13.92$, $p<.001$); CBCL, ($F(2, 24)=5.85$, $p=.009$); YSR, $p>.05$), but not for the NSA subgroup (all p's >.05). RSA data continued to show declines across time for the SA subgroup ($F(2, 50)=7.35$, $p=.002$), NSA ($p>.05$).
Conclusions: Results suggest the PEERS® intervention has a lasting positive impact on co-occurring symptoms of general and social anxiety, especially for adolescents who begin with high levels of social anxiety. Likely, as adolescents with ASD utilize social skills, their symptoms of anxiety decline. Interestingly, measures of arousal were not strongly related to anxiety, and implied that employment of social skills leads to heightened dysregulation, contrary to previous findings among neurotypicals (Porges, 2003). Perhaps, for adolescents with ASD in a social skills intervention, outcomes may be better explained by an Information Processing Model of RSA rather than the Social Engagement Model. That is, social interaction may require greater attention and more effort, associated with greater dysregulation and heightened arousal as these skills are employed. Further research is needed to better understand which of these competing models best explains social interaction in ASD across intervention. Longer-term follow up is also necessary to understand how these processes evolve over time.

197 **126.197** Hemispheric Asymmetry As an Electrophysiological Marker of Anxiety in Youth with Autism Spectrum Disorder

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Background: Research suggests that a left-dominant pattern of hemispheric asymmetry (HA) in frontal cortical EEG activity is associated with generalized approach motivation, whereas a right-dominant pattern is related to withdrawal (Coan & Allen, 2004). Converging evidence suggests that right-dominant HA is evident in youth with autism spectrum disorder (ASD; Shamay-Tsoory et al., 2010). While resting frontal HA is also linked to emotion-related disturbances, such as anxiety (Tibodeau et al., 2006), it is not clear whether HA is related to anxiety in ASD, which are frequently comorbid (Simonoff et al., 2008). Recent findings indicate that frontal HA may predict internalizing symptom treatment response in typically-developing individuals (Baskaran et al., 2012) and may be malleable to a common ASD social skills intervention (SSI; Van Hecke et al., 2015); yet, it is not clear whether HA is a potential predictor of anxiety-related treatment response to SSIs.
Objectives: This study examined whether frontal HA in ASD is a correlate of co-occurring anxiety and a predictor of anxiety-related improvements in response to a SSI.
Methods: Thirty-nine youth (M_{age}=12.23, SD_{age}=2.99; 30 male) with IQ≥70 (M_{IQ}=105.74, SD_{IQ}=15.35) and ADOS-2-confirmed ASD diagnosis participated in a 10-week SSI. Pre- and post-test measures included self- and parent-report of psychopathology symptoms (BASC-2; Reynold & Kamphaus, 2004), self-report of social anxiety (SAS; La Greca & Lopez, 1998), and parent-report of psychiatric symptomatology, impairment (CASI-5; Gadow & Sprafkin, 2013), and anxiety symptomatology (MASC-2; March et al., 1997).
At baseline, resting EEG data were collected for 6 minutes alternating between 1-min blocks of eyes open or closed. Frontal alpha-band (8-12Hz) power was computed using a Fast Fourier transform with an 80-ms Hanning window and 50% overlap across segments, resulting in a 0.5Hz frequency resolution. Differences of natural log-transformed scores [Ln(Right) – Ln(Left)] were calculated for mean alpha power across F3(L)/F4(R) and F7(L)/F8(R) pairs, such that positive scores indicate greater relative left frontal brain activity (as alpha is inversely related to brain activity).
Results: Bivariate correlations revealed associations between greater left frontal brain activity and lower parent-reported anxiety symptomatology, including CASI-5 social anxiety symptom severity and impairment, multiple domains on the MASC-2 (including GAD, separation anxiety, social anxiety, and physical symptoms), and BASC-2 anxiety (see Table 1).Â Moreover, ANCOVA-of-change models revealed that greater left brain activity predicted greater reduction on self-reported BASC-2 anxiety marginally (β=-.299, p=.069) and SAS social anxiety (β=-.314, p=.014), particularly in social avoidance and distress in new situations (β=-.398, p=.003), over the course of the SSI.
Conclusions: Overall, our findings suggest that frontal HA is a useful marker of anxiety in youth with ASD, as evidenced across multiple measures of anxiety symptomatology. Importantly, individual differences in frontal HA predicted improvements in anxiety symptomatology following the SSI; this pattern was especially pronounced for social anxiety in new situations, which is consistent with the social approach model of HA (Lopez-Duran et al., 2012). These results suggest that frontal HA could be important for parsing the heterogeneity in comorbid anxiety in individuals with ASD, and predicting who may show the greatest anxiety-related response to treatment.

198 **126.198** Common and Distinct Patterns of Functional and Structural Activity in Resting State Brain Networks in Autism and Social Anxiety

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Background:
Individuals with Autism Spectrum Disorder (ASD) also commonly have Social Anxiety Disorder (SAD), with up to 42-84% of those with ASD also meeting diagnostic criteria for SAD in their lifetime (de Bruin et al., 2007; Muris et al., 1998; Simonoff et al., 2008). Examination of possible disruption in the default mode network (DMN), which is active in the absence of task demands and involved in normative aspects of social cognition, may offer an opportunity to identify basic mechanisms responsible for heightened risk for social anxiety. Disruptions in the function of DMN would be expected in disorders characterized by alterations in social function. Consistent with this notion, both ASD and SAD are associated with altered activation of several core regions of the DMN. Despite emergent evidence for alterations within the same brain systems in SAD and ASD, as well as a behavioral continuum of social impairments, no study to date has examined the unique and common underlying brain systems within these disorders.
Objectives:
The primary aim of the current study is to characterize brain connectivity using a multimodal approach (e.g., functional and structural analyses) within the DMN in SAD, ASD, and controls.
Methods:
Forty-five individuals (15 per group; mean age = 23.92) participated in this study. Functional connectivity analyses were conducted by using resting-state fMRI data to identify intrinsic connectivity via independent components analysis (ICA). The ICA approach is based on FSL's MELODIC (Beckmann et al., 2005).
To evaluate the structural connectivity of the DMN, we examined diffusion tensors via AFNI's FATCAT (Taylor & Saad, 2013). We selected regions of interest (ROIs) based on the DMN (Left and Right Parietal Region, Posterior Cingulate Cortex (PCC), Anterior Cingulate Cortex (ACC)) to examine the structural integrity between these regions.
Results:
Functional analyses revealed increased coactivation of the dorsomedial prefrontal cortex in ASD and SAD compared to controls, $p < .05$.
Structural analyses revealed both over and under white matter fiber connectivity in ASD compared to both controls and the SAD group. Specifically, there were significant differences between the ASD and control group for the Right Parietal Region <--> ACC connectivity contrast, $p = 0.0387$, and the ASD and SAD groups, $p = 0.039$. This difference was not found between the SAD and control groups, $p = 1$. In the Left Parietal Region <--> PCC connectivity contrast, we found a significant difference between the ASD group and control group, $p = 0.20$, and ASD and SAD group, $p = 0.019$, but not between the SAD and control, $p = 0.667$.
Conclusions:
These results may hold significance for clinical treatment of ASD with comorbid SAD. Treatment of ASD often targets specific symptoms and ranges from speech to social and cognitive skills without insight into the neural structures subserving the mechanisms of social deficits (Reichow & Wolery, 2009; Dawson & Bernier, 2013). Knowledge of potentially common neural and physiological processes subserving social deficits could aid identification of treatment informed by the underlying mechanisms.

199 **126.199** Experiential, Behavioral, and Physiological Correlates of Mixed Emotions in Individuals with Autism Spectrum Disorder

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Background: Mixed emotions are the co-occurrence of two or more differing emotional feelings (Larsen & McGraw, 2011) and their understanding can be seen as a sign of emotional maturation (Harris, 1989).
Objectives: The goal of this study was to examine experiential, behavioral, and physiological correlates of positive, negative, and mixed emotions in individuals with Autism Spectrum Disorder (ASD) compared to typically developing (TD) individuals. Social cognitive processing was required to process the film clips, since they required either the ability to understand humor (positive film clips), to understand other people's pain (negative film clips), or both simultaneously (mixed film clips).
Methods: Twenty-seven participants with ASD (4 female; FSIQ: *M*=101.74, *SD*=18.34) and 32 TD participants (9 female; FSIQ: *M*=112.75, *SD*=11.43) between 8 and 20 years (*M*=12.85, *SD*=2.96) were asked to rate amusement and repulsion on a scale from 1 (not at all) to 5 (very strongly) after each of 18 film clips eliciting either pure positive (i.e., amusement in the face of humorous lapses), pure negative (i.e., repulsion in the face of painful accidents), or mixed emotions (i.e., amusement and repulsion in the face of ambiguous bloopers) while facial electromyographic (zygomatic and corrugator activity), cardiac (heart rate), and electrodermal (skin conductance) activity was measured during presentation of films. Since groups differed in FSIQ, all analyses included FSIQ as covariate.
Results: Preliminary analyses revealed that the three film clip categories induced as expected positive, negative, and mixed (as assessed with the minimal shared feeling of amusement and repulsion, Schimmack, 2001) emotional states, as revealed by self-report and facial expressions. However, the three conditions did not reveal differences in cardiac and electrodermal activity. Main analyses revealed that individuals with ASD did not differ from TD participants in their self-reported amusement and smiling behavior (zygomaticus activity). However, individuals with ASD experienced more repulsion towards positive film clips and less repulsion towards mixed and negative film clips, while expressing less frowning behavior (corrugator activity) in all three conditions. Individuals with ASD experienced more mixed feelings in response to positive film clips, and showed a tendency to experience less mixed feelings in mixed film clips. Finally, no differences were observed between the two groups in cardiac or electrodermal activity.
Conclusions: Individuals with ASD have similar positive emotional responses to positive, mixed, and negative film clips suggesting no differences in humor processing, but showed mainly differences in their self-report and expressive behavior when it comes to negative emotional responses. Decreased repulsion experience and expression towards mixed and negative film clips might be linked to lower sensitivity towards pain of others. Interestingly, mixed emotions are higher in individuals with ASD towards positive film clips, also related to higher negative emotional experience in this condition. Group differences in mixed feelings may be due to an altered repulsion experience in individuals with ASD. Since there were no group differences in cardiac and electrodermal activity, future studies should examine synchronization of emotional response components in individuals with ASD compared to TD participants.

200 **126.200** The Role of Alexithymia in Emotional Reactivity and Emotion Regulation in Children with Autism Spectrum Disorder

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Background: Emotional disturbances, including emotional reactivity and regulation difficulties, are common among children with autism spectrum disorder (ASD) and pose risk factors to other problematic behaviors. In addition, alexithymia has a high prevalence among individuals with ASD and has been considered to be more relevant in the development of emotional problems than ASD symptoms themselves.
Objectives: Â The present study aimed to examine the effect of alexithymia on emotional reactivity and regulation difficulties in children with ASD compared to typically developing (TD) children.
Methods: Â Thirty-seven children previously diagnosed with ASD (5 female) and 41 TD children (9 female) and their parents participated in the study. Children were aged 3 to 13 years old. A multi-method assessment of children's emotional reactivity and emotion regulation measures including parent-reports (Emotion Regulation Checklist; Shields & Cicchetti, 1997), behavioral observations (frequency of facial expressions' valence; use of emotion regulation strategies), and physiological measures (percentage of change in heart rate; respiratory sinus arrhythmia) were used together with a parent-report of children's alexithymia (adaptation of the Alexithymia Questionnaire for Children; Rieffe et al., 2006). The study took place in one visit during which parents were requested to fill out questionnaires and then an electrocardiogram measurement of the child took place at rest and during a frustration eliciting situation (Attractive Toy Removal; Goldsmith & Rothbart, 1999). The study was reviewed and approved by an ethics review panel.
Results: Â Children with ASD had a significantly higher alexithymia score than TD children [$t(76)=4.98$, $p<.001$, $d=1.13$]. Compared to TD children, children with ASD had more difficulties in all indicators of emotional reactivity even after controlling for alexithymia: parents of children with ASD reported higher lability/negativity in their children compared to parents of TD children [$F(1,75)=11.93$, $p<.01$, =.14], children with ASD expressed more negative emotions than TD children [$F(1,75)=15.66$, $p<.001$, =.17], and the absolute percentage of HR change in children with ASD was higher than in TD children [$F(1,70)=6.26$, $p<.05$, =.08]. Similarly, children with ASD had more difficulties in all indicators of emotion regulation even after controlling for alexithymia: parents of children with ASD reported lower emotion regulation ability than parents of TD children [$F(1,75)=5.49$, $p<.05$, =.07], children with ASD used less adaptive emotion regulation strategies than TD children [$F(1,75)=16.13$, $p<.001$, =.18], and resting respiratory sinus arrhythmia was lower in children with ASD than in TD children [$F(1,72)=4.39$, $p<.05$, =.06]. Hierarchical regression models indicated that alexithymia contributed significantly to the explanation of certain aspects of emotional reactivity, but did not contribute further to explain emotion regulation difficulties.
Conclusions: Our results show that children with ASD, compared to TD children, have more negative emotional reactivity, more difficulties in emotion regulation, and increased levels of alexithymia. Moreover, alexithymia plays an important role in the explanation of emotional reactivity but does not seem to contribute to difficulties regulating emotions. Therefore, these findings suggest that interventions targeting emotional reactivity would benefit from integrating alexithymia, and that interventions specifically targeting emotion regulation could help alleviate emotional disturbances in ASD.

201 **126.201** Emotion Regulation Strategies in Preschoolers with Autism Spectrum Disorder: Associations with Wellbeing, Sleep and Temperament

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Background: Emotional dysregulation has been shown to be strongly associated with challenging behaviours and mental health problems in children. Recent studies have highlighted that children with Autism Spectrum Disorder (ASD) use less adaptive strategies for regulating their emotion and tend to have a limited repertoire of regulatory behaviours compared to their typically developing (TD) peers, however it is unknown how these strategies map on to wellbeing, mental health and associated factors in children with ASD.
Objectives: To explore differences in emotion regulation strategies between children with ASD and matched controls and to examine relationships between emotion regulation strategies, mental health, quality of life, sleep quality and temperament.
Methods: 44 children with ASD and 29 matched controls (2- 4 years) were administered tasks from the Laboratory Temperament Assessment Battery. Tasks were designed to mimic everyday life experiences in which children would need to regulate low-level stress (e.g. waiting for a snack). Coders blind to diagnostic group coded twelve emotion regulation strategies (see Figure 1), ranging from adaptive (e.g. social strategies) to maladaptive (e.g. avoidance) strategies. Parents reported on their child's mental health, quality of life, sleep quality and temperament.
Results: Â As can be seen in Figure 1, children with ASD used significantly fewer social strategies mediated through unfamiliar people (researchers), $t(71) = 4.87$,Â pÂ < .001, more avoidance, $t(71) = -3.68$,Â pÂ < .001, and marginally more physical comfort from their parents, $t(71) = -1.90$,Â $p = .06$, compared to controls. For children with ASD, greater wellbeing was related to less perceptual disengagement, $r(41) = -.30$,Â $p = .05$, and self-soothing, $r(41) = -.28$,Â $p = .07$. For children with ASD only, longer sleep time was related to social strategies, mediated through unfamiliar people $r(43) = .42$,Â $p < .01$. Social strategies mediated through family members was negatively associated with effortful control in the TD group, $r(27) = -.36$, $p = .06$, but positively associated in the in the ASD group $r(42) = .33$, $p = .03$.
Conclusions: These findings suggest that children with ASD use less adaptive and more frequent physical comfort strategies than children without ASD. Unique relationships of emotion regulation strategies in ASD were identified, highlighting the link of sleep with social strategies and wellbeing with less use of maladaptive strategies. TD children who have higher effortful control skills appear to rely less on family members to mediate low-level stress, whereas for the children with ASD this relationship is reversed.

202 **126.202** The Efficacy of a Novel Emotion Regulation Group Intervention in Parents of Children with ASD

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Background:
Children with Autism Spectrum Disorder (ASD) have impairment in reading socio-emotional information such as affect, social cues, and facial expressions and often experience less reward in social interaction. These characteristics limits children's capacity to understand their own mental state, that is, to mentalize. From the parent's perspective the child's "mindblindedness" makes him a most challenging social partner who brings only few rewards into the relationship. A child with ASD needs a supportive relationship to survive, but even more than most children he needs his parents to be stable regulators of his experiences and emotions. Thus, parents need to make sense of what seems incomprehensible and unrewarding to their child with ASD.
Objectives:
The goal of this pilot study was to examine the effectiveness of a novel Regulative Parenting Workshop in teaching mentalization, reflective functioning, and emotion regulation skills in parents of children with ASD.
Methods:
The study involved a non-randomized controlled 4-week trial. Parents were assigned to treatment or control groups. Measures included Parental Developmental Interview (PDI) that assesses the parent's mentalization level. Children's internalizing and externalizing behavior, and total problems were assessed with the Child Behavior Checklist. Measures from the treatment group were taken at baseline before the workshop and at 4 weeks after completing the workshop. Measures from the control group were taken twice with an interval of 3-4 weeks between the two assessments.
Twenty-three parents in the treatment group and 24 parents in the control group completed assessments at all time points and were included in the analysis. There were no differences at baseline between the groups on any demographic variable. Parents age ranged from 31-64 years. Eighty percent were female, and 19.6% were male. A large majority of participants were married (95.6%), 2.2% were single, and 2.2% were in a committed relationship. The majority of participants had completed masters degree or graduate degree (51.2%), 18.6% had a bachelors degree, and 20.9% completed college.
Results: Preliminary analyses from this pilot investigation revealed that parents receiving the intervention showed significant increase in total mentalization level based on the PDI ($F(1,45)=4.5$, $p=.04$). Moreover, parents in the intervention group increased in mentalization on all PDI subscales except of one. Children's total problems ($F(1,41)= 11.18$, $p=.002$), internalizing behavior ($F(1,41)=6.62$, $p=.014$), and externalizing behavior ($F(1,41)=2.85$, $p=0.05$) decreased in the treatment group, but not in the control group.
Conclusions: Parents of children with ASD were able to improve their mentalization capacity towards their children after four group sessions focused on constructive strategies to regulate emotions. It seems that the parent's capacity to mentalize the child by itself has a strong regulative effect. Parents reported after the workshop that the children's symptoms decreased. It may be possible that the parents' perception about the child's symptoms changed and not necessarily the symptoms. However, changing the perception about the children's symptoms may be an important goal by itself. Future studies are needed to replicate these observations in a randomized controlled investigation of a larger sample of participants.

203 **126.203** Inter-Relationship Between Insistence on Sameness, Effortful Control and Anxiety in Adolescents and Young Adults with Autism Spectrum Disorder

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Background:
Insistence on Sameness (IS) behaviours include complex patterns of rigid, routinized and ritualistic patterns of behaviour. In addition to being a diagnostic feature of autism spectrum disorder (ASD), these behaviours also form part of typical development. Whilst IS behaviours in ASD tend to be relatively stable over time and negatively impact the functioning of individuals and their families, in early typical development, these behaviours are transitory and often serve an adaptive role. More specifically, these behaviours appear to be related to normative fears and anxieties, serving as an early form of self-regulation, and eventually reducing as more advanced forms of self-regulation develop. In ASD, it is possible that IS behaviours continue to serve a regulatory function beyond the period when they should have been replaced by more developmentally appropriate forms of self-regulation. Thus IS behaviours may negatively affect development including sustaining anxiety. However, this proposal has not been previously tested.
Objectives:
The aim of the present study was to characterise the IS-self-regulation-anxiety inter-relationship by investigating the potential contribution made by self-regulation, measured via effortful control, to the IS-anxiety relation in a cross-sectional sample of adolescents and young adults with ASD.
Methods:
Participants were 58 adolescents and young adults with ASD (40 males, 18 females; M_{age}= 19.14 years, SD_{age}= 2.53, range: 15.71-24.91) who participated in the Autism CRC School leavers study. As a part of the study, participants completed the Adult Repetitive Behaviours Questionnaire-2 (RBQ-2A), Effortful Control Domain of the Adolescent/Adult Temperament Questionnaire and DSM-5 Dimensional Anxiety Scales (DSM-5 DAS) as measures of IS behaviours, Effortful Control and anxiety respectively.
Results:
The cut-off score (≥ 14) for elevated anxiety was met by 44.8% of participants. Preliminary analysis showed no statistically significant association between chronological age and gender and IS behaviours, anxiety, or effortful control scores. IS behaviour score was associated with both effortful control (r = -.42, p = .001) and anxiety (r = .47, p < .001), and anxiety was in turn associated with effortful control (r = -.51, p < .001). In order to characterise the nature of this interrelationship, two mediation analyses were performed using the serial mediation model in PROCESS with 5000 resamples in bootstrapping. There was a significant indirect effect of effortful control on anxiety through IS (Model 1a; b = -.06; BCa CI [-.13, -.02], standardized effect size = .13; BCa CI [-.27, -.04]) and there was a significant indirect effect of effortful control on IS through anxiety (Model 1b; b = -.006; BCa CI [-.01, -.002], standardized effect size = -.17; BCa CI [-.34, -.06]).
Conclusions:
Our study provides first exploration of the IS-anxiety-self-regulation inter-relationship in ASD. However, findings are limited by a cross-sectional nature of our data, as cross-sectional designs are unable to capture these dynamic processes as they unfold over time. Despite this limitation, our study has potential implications for interventions targeting IS behaviours and also anxiety in ASD. Our finding that lower levels of self-regulation are related to both anxiety and IS behaviours, suggest self-regulation as a viable intervention target.

204 **126.204** Effects of Emotion Regulation and Intolerance of Uncertainty on Anxiety and Depression in Adolescents and Young Adults with Autism

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Background:
Anxiety and depression are very frequent and disabling comorbid psychiatric conditions in individuals with autism, however, the reasons for such high prevalence are currently poorly understood. Emotion regulation (ER) and intolerance of uncertainty (IU) are factors most commonly implicated in the development and maintenance of anxiety and depression in non-ASD population. Recent research has started to explore the role of IU and ER in autism and some patterns are emerging e.g., maladaptive ER strategy use predicts internalizing symptoms and IU is a predictor of anxiety. However, previous research has not addressed relationship between IU and ER and depression, nor assessed the inter-relationship between ER and IU in predicting anxiety and depression.
Objectives:
To assess the inter-relationship between ER, IU, anxiety, and depression. It is hypothesized that both IU and ER strategy use would have direct and indirect effects on anxiety and depression, over and above autism symptoms, gender, and age. These effects will be tested using four mediation models: IU as a predictor of anxiety and depression (separately), mediated by ER, and ER as a predictor of anxiety and depression (also separately), mediated by IU.
Methods:
Forty-eight individuals with autism (13 females; M_{age}= 18.20 years, SD_{age}= 2.41) completed the online questionnaires Autism Spectrum Quotient-28 (AQ-28), Patient Health Questionnaire-9 (PHQ-9), Dimensional Anxiety Scale for DSM-5 (CROSS-D), Emotion Regulation Questionnaire (ERQ), and Intolerance of Uncertainty Scale-12 (IUS-12). For analyses, instead of using the suppression and reappraisal sub-scale scores, an ERQ ratio was calculated by diving the suppression score by the reappraisal score.
Results:
Pearson's correlation analyses with bootstrapping showed ERQ ratio was moderately associated with IUS-12 (r=.37), CROSS-D (r =.40) and PHQ-9 (r =.47). IUS-12 was strongly associate with CROSS-D (r =.60) and PHQ-9 (r =.62). Age, gender, and AQ-28 were not associated with any of these four variables. Following the mediation model analyses, these results were found: 1) ER mediated the effect of IU on depression (b = 0.72, BCa CI [0.06, 1.79]), 2) ER did not mediate the effect IU had on anxiety (b = 0.68, BCa CI [-0.06, 1.81]), 3) IU mediated the effect of ER on anxiety (b = 3.89, BCa CI [0.67, 8.42]), and 4) IU mediated the effect of ER on depression (b = 2.98, BCa CI [0.41, 6.07]).
Conclusions:
Consistent with previous research, individuals with autism who reported greater levels of IU and greater use of suppression reported higher symptoms of anxiety and depression. This study also builds on previous research by characterizing the nature inter-relationships between IU, ER, anxiety and depression for the first time. These findings have significant implications for designing intervention programmes for anxiety and depression in ASD; treatments combining both Cognitive Behavioural Therapy with the goal of increasing tolerance of uncertainty and Acceptance Commitment Therapy to accept painful emotions and thoughts in order to modify behaviour may be most effective for individuals.

205 **126.205** Addressing Intolerance of Uncertainty in Anxious Young People with Autism Spectrum Disorder

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Background:
Anxiety is a significant problem for many children with autism spectrum disorder (ASD), who frequently present with multiple anxiety disorders concurrently. Treatments targeting underlying anxiety mechanisms may therefore be most efficacious. Over the last five years our group has worked towards providing a theoretically informed formulation of anxiety in ASD. This work has focused on a consideration of a well-established model of anxiety: the Intolerance of Uncertainty Model. *Intolerance of uncertainty* (IU) is a 'broad dispositional risk factor for the development and maintenance of clinically significant anxiety' in neurotypical populations. The concept of IU has utility not only to theoretically inform understanding of the factors underlying the development and maintenance of anxiety, but has also been shown to be a beneficial target for treatment. Intervention studies with neurotypical individuals with high IU provide evidence that reduction of IU is associated with reduction in anxiety. Cognitive behavioural treatments for clinically anxious patients have been developed which emphasise treating the cognitive *process* rather than the cognitive *content* of anxiety, specifically by aiming to increase patients' tolerance for uncertainty and thereby achieving more sustainable change. Over the past five years research has investigated the relevance of IU to anxiety in ASD. This work indicates that IU is a key construct in anxiety in children and adolescents with ASD, which may account for the increased vulnerability to a range of anxiety disorders in this population.
Objectives:
Our objective was to develop and evaluate the feasibility and acceptability of a parent mediated, group intervention targeting IU for young people with ASD.
Methods:
Phase One: Parent focus groups informed the development of the materials and trainers' manual. An eight week manualised intervention programme was developed; *CUES, Coping with Uncertainty in Everyday Situations©*. The treatment provides parents of children with ASD, with effective strategies to reduce their child's IU in everyday situations.
Phase Two: The programme was delivered to 11 parents of children with ASD, aged between 8 and 15 years across three treatment groups, two recruited via a research data base and one via clinical services. The intervention included in-session activities and homework tasks, which focus on increasing tolerance of uncertain situations. Baseline and outcome measures assessing child and parent anxiety and IU were completed. Individual follow-up interviews were undertaken with parents to ascertain acceptability and feasibility.
Results: Â Data regarding retention, acceptability and feasibility indicate that the parents who participated valued the programme. Preliminary data relating to effect size analyses of outcome measures indicate that the programme has promise as a treatment option of young people with ASD and IU. Parents reported a reduction in their own and their child's intolerance of uncertainty and anxiety subsequent to participation on the programme.
Conclusions:
The findings indicate that parents of young people with ASD view an intervention which focuses on intolerance of uncertainty to be valid and meaningful. The data available indicate that CUES may have promise as a targeted package to assist young people with ASD and their families to manage their responses to uncertainty.

206 **126.206** A Randomized Controlled Trial Comparing Online Mindfulness and CBT Programs to Alleviate Anxiety in Adults with ASD.

S. B. Gaigg[1], *R. Shah*[1], *G. Mclaven*[1], *P. Flaxman*[1], *D. M. Bowler*[1], *B. Meyer*[2], *A. Roestorf*[1], *C. Haenschel*[1], *J. Rodgers*[3] *and M. South*[4], *(1)Psychology, City, University of London, London, United Kingdom, (2)Psychology, University of Southampton, Southampton, United Kingdom, (3)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom, (4)Psychology and Neuroscience, Brigham Young University, Provo, UT*

Background: Anxiety Disorders are around five times more common in ASD than in the general population and are widely recognised as an important treatment target due to the consequences for an individual's quality of life and broader wellbeing. The choice and effective delivery of treatments, however, is complicated because the mechanisms that mediate anxiety in ASD remain poorly understood and the frequent necessity to interact with therapists is costly and also problematic because of the high demands on social-communication skills. Maisel et al., (2016) have recently shown that Intolerance of Uncertainty (IoU), Alexithymia (Alx) and Non-reactive thinking (NR) play a critical role in mediating anxiety in ASD, suggesting that Cognitive Behavioural Therapies (CBT) and Mindfulness-Based Therapies (MBT) may be differentially effective by targeting IoU and Alx/NR respectively.
Objectives: 1) To examine the effectiveness of online CBT and MBT programs to alleviate anxiety in ASD, 2) to establish whether treatment effects are mediated by changes in IoU and Alx/NR, 3) to determine whether reductions in anxiety translate into wider benefits for the wellbeing of individuals with ASD.
Methods: Thus far, thirty-three adults with ASD have been randomly allocated to either a CBT (n = 10), MBT (n = 10) or Waitlist (WL) group (n = 13), matched at baseline for age, ASD symptoms and IQ. Participants in the CBT and MBT groups received instructions on how to pursue respectively the existing online programs *Serenity* (*http://serene.me.uk/)* or *BeMindful* (http://bemindful.co.uk/) for between 4 – 6 weeks. Participants learned different stress and anxiety management strategies each week, and a reflective diary served to monitor how frequently and feasibly these were practiced in daily life. Participants in all groups completed measures of Anxiety (BAI, STAI-T, LSAS, GAD-7), broader wellbeing (HADS, CORE-OM), intolerance of uncertainty (IoU-12), Alexithymia (BVAQ) and Mindfulness (FFMQ) at enrolment and again at completion of the 6-week period.
Results: At baseline, results confirmed that IoU and NR are significant and independent predictors of trait (STAI; R^2=.37) and generalised (GAD; R^2=.22) anxiety, which in turn are highly correlated with the CORE-OM index of general wellbeing (STAI: r = 0.81; GAD: r = 0.75). Across the 21 participants (5 MBCT, 7 CBT & 9 WL) tested so far at time 2, reductions are evident particularly in generalised anxiety ($F(1,19) = 7.01$, $p < .05$) with large effects in both the CBT (Cohen's d = .85) and MBT (Cohen's d = .74) but not the WL group (Cohen's d = .13). Improvements in more general wellbeing (CORE-OM)Â were also evident ($F(1,19) = 5.90$, $p < .05$) and the preliminary data suggest that IoU and NR do indeed play a role in mediating treatment benefits. Contrary to predictions no effects were observed in relation to Alexithymia.
Conclusions: Online CBT and MBT programs provide viable treatment options for anxiety in ASD that translate into wider benefits for general wellbeing. The discussion will focus on feedback from participants that provides useful pointers on how to tailor existing programs more specifically to the needs of those with ASD.

Poster Session
127 - Service Delivery/Systems of Care
5:30 PM - 7:00 PM - Golden Gate Ballroom

207 **127.207** A Pragmatic Comparative Trial of Educational Service Delivery Models for Children with ASD

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Background: Different approaches to educational service delivery for children with ASD in regular schools are available, based on different conceptual and theoretical underpinnings. Nevertheless, there has been little comparative research examining outcomes and predictors of success under different models. Two approaches to the support of children with ASD in Australian primary schools are the Consultative model used by Autism SA in South Australia (SA) and the Satellite Class model used by Autism Spectrum Australia (Aspect) Aspect in New South Wales (NSW). The Satellite model provides placement into an autism specific class in regular school, with phased transition and support to mainstream when the child is adequately prepared. The Consultative model provides on-demand support in mainstream classes from the point of school entry.
Objectives: The objective of this research was to examine comparative outcomes and predictors of success across the two models of service delivery.
Methods: Â A four-year comparative pragmatic trial of the models was conducted with 85 children. Inclusion criteria for the project were that the child must have a formal diagnosis of Asperger's disorder or autistic disorder (DSM-IV), be functioning within or above the mild range of intellectual disability, be in their first four years of schooling at the project commencement. Data were collected twice yearly. Primary child outcomes identified prior to the commencement of the project related to continuity of placement, social behaviour, school engagement and adjustment. Primary outcomes for school staff and parents related to satisfaction with service delivery and perception of the success of placement. A multilevel model approach to data analysis was taken. Predictors of each outcome variable, including program model, were examined with data structured as rounds (repeated measure), nested within child, and nested within school (i.e., three-levels).
Results: Â Continuity of placement was high in both models. Satellite class transitions were lower than expected with many families electing to remain in satellite classes. With regard to child social skills and school engagement and adjustment, there was no significant difference between the models of service delivery, and the only significant predictor of both was teacher-rated academic competence. Mean level of rated placement success was high in both states across all respondents, typically scoring between 4 and 5 on a 5-point scale. Principal and teacher-rated success of placement was not different between states, and adaptive behaviour at pre-test was a significant predictor of successful outcome for both. Parents in NSW rated school placement in the satellite classes as more successful. Both parent and teacher ratings of success trended down across the study, and children with greater problem behaviours were rated as less successful by both. Both principals and parents rated support as being better in NSW.
Conclusions: Child outcomes were not significantly different but some differences were evident in perceived success of placement and satisfaction with support. Adaptive behaviour at pre-test was a predictor of rated success of placement. While intensity of support differed across the models of support, both included several basic features that are considered best practice in support of children with ASD.

208 **127.208** A Profile on ED Visits in Children Aged 6-12 with Autism Spectrum Disorders

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Background: Â Research suggests the utilization of the emergency department by children and adolescents in the general population has steadily increased over the past decade. There is a need to better understand emergency department use by school age children with ASD, as the cost of medical care for children with ASD is greater despite the reported unmet need for service. Past studies have been descriptive in nature, and have outlined the common complaints of ED visits through caregiver-report data and small-scale retrospective chart reviews.
Objectives: Â In this study, we use a large, national healthcare claims database to examine emergency department utilization over nine years (2005 – 2013) in children aged 6 to 12 years with ASD. The goal of this study is to provide an assessment of ED visits as an indicator of the physical and mental health well-being of children with ASD as well as the healthcare service for them.
Methods: Â Using the 2005-2013 MarketScan® Commercial Claims and Encounters database, we identified cohorts of children aged 6-12 who had at least one ED visit during any of those years. We constructed a sub-cohort of children with at least two separate diagnoses of ASD (ICD 9 codes 299.0x and 299.8x) and a sub-cohort of children without ASD. We also broke down the entire cohort into annual cohorts. In each of the annual cohorts as well as in the combined cohort, we described the proportion of patients who visited the ED.
Results: As Figure 1 shows, through the last decade, ED visits among children aged 6-12 with ASD have remained steady with no apparent increase, although slightly higher than non-ASD children of the same age. This was in dramatic contrast to a previous study that showed steady increases in ED visits among adolescents aged 12-21. As shown in Figure 2, we also observed a slight increase in behavioral health-related ED visits among children with ASD, with almost 20% of ED visits being for a behavioral health issue in the most recent years. Multi-variable regression showed that, after adjusting for confounders such as age, gender, census region and type of health insurance plan, children with ASD were 50% more likely to have ED visits compared to children without ASD (adjusted odds ratio [aOR] 1.579, confidence interval [CI] 1.550-1.609). Among other confounders, sex also was significant associated with ED visits, with boys more likely to have ED visits than girls (OR: 1.214, CI: 1.209-1.219).
Conclusions: Our study revealed that the rate of ED visits among children aged 6-12 with ASD was fairly flat between 2005 and 2013, and was only slightly higher than the rate among children without ASD in the same age bracket. On the other hand, we observed a steady increase in ED visits primarily associated with behavioral health conditions, suggesting an ASD-related mental health crisis.

209 **127.209** A Profile on Hospitalization Subsequent to ED Visits in Adolescents with Autism Spectrum Disorders

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Background: The prevalence of ASD began to increase dramatically about a decade ago, and now the first wave of these children has approached adolescence and early adulthood. While early diagnosis and intervention have been the focus of the scientific and clinical communities, the population of adolescents with ASD has not received the same attention. Although various ASD-related healthcare services have been designed to better serve this population, it is relatively unknown how well they are being served.
Objectives: In this study, we use a large, national healthcare claims database to compare the healthcare utilization history (in-/out-patient medical records) of adolescents with and without ASD, with a focus on hospitalization due to emergency department visits. The goal of this study is to provide an assessment on patterns of hospitalizations subsequent to ED visits as an indicator of the physical and mental health well-being of adolescents with ASD.
Methods: Using the 2005-2013 MarketScan® Commercial Claims and Encounters database, we identified cohorts of patients who had at least one ED visit during any of those years. We constructed a sub-cohort of children with at least two separate diagnoses of ASD (ICD 9 codes 299.0x and 299.8x) and a sub-cohort of children without ASD. We also broke down the entire cohort into annual cohorts. In each of the annual cohorts as well as in the combined cohort, we described the proportion of patients whose ED visits resulted in subsequent hospitalizations. We also compared the hospital length of stay among ASD vs. non-ASD patients.
Results: Â As observed in Figure 1, a consistently higher proportion of adolescents with ASD had an ED visit leading to hospitalization than adolescents without ASD. In particular, the odds ratio (OR) of admission to hospital after ED among ASD and non-ASD patients was 4.226, with a 95% confidence interval (CI) of 4.047 – 4.412]. Older adolescents (28.22% ASD vs. 8.13% non-ASD for age 18-21; 27.39% ASD vs. 8.15% non-ASD for age 15-17) were more likely to be hospitalized after an ED visit than younger adolescents (22.92% ASD vs. 6.26% non-ASD for age 12-14). While males and females were equally likely to be hospitalized after ED visits among adolescents without ASD (7.61% male vs. 7.69% female), female adolescents with ASD were more likely than males (28.02% vs. 25.13%) to be admitted to the hospital after an ED visit. Adolescents with ASD were also more likely to stay in the hospital longer (average days of hospitalization: 6.38 ± 8.10) than adolescents without ASD (3.97 ± 5.65). Adolescents with ASD were more likely to be hospitalized 3 days or longer (70.76% vs. 51.13) and 7 days or longer (31.55% vs. 15.13%) than adolescents without ASD.
Conclusions: Our study showed a disconcertingly high proportion of adolescents with ASD who had hospitalizations subsequent to emergency department visits over the past decade or so. Furthermore, adolescents with ASD who were hospitalized had longer lengths of stay than adolescents without ASD, suggesting a vulnerability of having physical injuries and/or medical complications, potentially due to an ASD-related mental health crisis.

210 **127.210** Access to Diagnostic and Autism-Related Services in Under-Resourced and Minority Families: Barriers and Enablers for Families and Educational Service Providers

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Background: Children with ASD from under-resourced and ethnic minority families are diagnosed and enter treatment later than other children (Mandell et al., 2002). Common barriers to accessing care include socioeconomic factors, availability of medical treatment and insurance, and knowledge of child development. Although previous research has reported on potential barriers, it is still unclear which factors *enable* these families to access diagnostic or educational services. Further, little research has examined barriers and enablers related to delays in care for this population using first-hand information gained from qualitative interviews.
Objectives: To identify barriers to care and resources perceived as helpful in obtaining services for underserved minority families in a large city.
Methods: Focus groups (3) and interviews (11) were conducted in a large urban setting to learn about perceived barriers and facilitators to accessing evaluations and autism-specific services. Participants included 28 providers and 24 caregivers of recently diagnosed children with autism from under-resourced communities. Providers were those who worked with families that met the above criteria.
After coders established inter-rater reliability with the master coder (2 consecutive transcripts at $\varkappa$> .60), the qualitative data were analyzed in Dedoose using open coding and then thematic analysis. All transcripts were coded by two independent coders to insure inter-coder reliability.
Results: Several barriers to obtaining an ASD diagnosis as well as autism-related services were identified. Barriers included: (1) poor accessibility for non-native English speakers, (2) stigma related to the diagnosis, (3) absence of knowledge of ASD and the service system, (4) lack of financial resources and transportation, (5) provider's lack of cultural sensitivity, and (6) limited community resources (e.g., availability of local services).
Participants also reported on helpful resources. These included: (1) provider advocacy on behalf of the family, (2) providers taking the role of "students" of the family's culture, (3) providers creating culturally matched videos for parent training, (4) providers initiating parent engagement strategies (e.g., using texting as a mode of communication, including parents in goal development), (5) culture and language matched parent peers to help guide families, and (6) technology for language accessibility.
Conclusions: Caregivers and providers of children with ASD consistently identified similar barriers to accessing care for families from culturally diverse and under-resourced backgrounds. Common barriers such as language specific difficulties, stigma associated with ASD, and accessibility of services often lead to a delay in diagnosis and access to services for minority children with autism. However, participants also identified specific supports or enablers perceived as useful in obtaining a diagnosis or related services, such as, provider advocacy, culturally matched supports, and other language-based accommodations. These findings highlight important considerations for providers working with under-resourced and ethnic minority families and suggest a need for systemic changes in order to facilitate earlier access to an autism diagnosis and services in under-resourced communities.

211 **127.211** Access to Related Services for Students with Autism Spectrum Disorder in a Large School District

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Background: Disparities exist regarding diagnosis and access to services for individuals with Autism Spectrum Disorder (ASD). Students with ASD between the ages of 3 to 21 receive special education services and related services based on the Individuals with Disabilities Education Act (IDEA). Little research has been conducted on access to related services within a school district.
Objectives: RQ (1): Do categories of related services vary by race, gender, grade, and median income for students with ASD in 5th and 8thgrade? RQ (2): As students with ASD transition from 5th to 6th grade and 8th to 9th grade, what changes occur in the categories of related services and whether related services vary by race, gender, and median income?
Methods: Using secondary data analysis from a large urban school district, participants included 1,324 students with ASD in 5th and 8th grades in the 2012-2013 school year who matriculated to 6th and 9th grade, respectively, in the 2013-2014 school year. Twenty related services were recoded into six categories of related services (i.e., Health, Behavioral Support, Motor Skills, Senses, Academic, and Communication). The median income variable was created using student zip code and 2010 census data. Descriptive analyses and binary logistic regressions were conducted to determine if race, gender, grade, and median income served as predictors of whether or not students with ASD in 5th grade and 8thgrade received the categories of the related services. Since most students did not receive a change in the categories of related services (0=no change), regression analyses were not feasible. Instead, descriptive statistics were used to understand the types of changes that occurred as students transitioned from one grade level to the next without the use of the predictor variables.
Results: As hypothesized, median income predicted categories of related services. Median income predicted half of the categories of related services when controlling for gender, grade, and race. Latino and Asian students had lower odds of receiving Academic Support services compared to White students. Females were more likely to receive health services compared to males. Compared to 5th grade students, students in 8th grade were 1.406 times more likely to have an increase in behavioral support service. However, students in 8thgrade were less likely to receive health services compared to 5th grade students. Over 90% of students received no change in related services as they transitioned from one grade level to the next.
Conclusions: The study examined the types of related services students with ASD received as they transitioned from elementary to middle school and from middle to high school and whether disparities exist when accessing related services in school districts. Students received more related services based on family median income. Female students and White students received more services than their counterparts. Students with ASD who transitioned from 5th to 6th grade and 8th to 9th grade received little to no change in related services.

212 **127.212** Advancing Family-Centred Health Care for Autism and Related Conditions through Integrated Research

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Background: Relative to the large body of research available in autism, translation of evidence into sustainable improvements to care delivery is limited. Among the barriers to translation is that research in autism has traditionally been done in parallel or subsequent to care delivery. Moreover, families who participate in research are not always a representative group of health-services users, thus limiting generalizability of findings into clinical practice. The use of a learning healthcare system approach (e.g., Friedman et al., 2010) is one strategy to accelerate research and its translation of the best available knowledge into population health benefits.
Objectives: We conducted a clinical quality improvement study to identify strategies and tools that can enhance integration of research into routine care in tertiary diagnostic centres in the province of Quebec, Canada. Specifically, we used a qualitative approach to examine facilitators and barriers to capturing clinically valid and standardized phenotypic information derived from diagnostic assessments of children referred for ASD assessments.
Methods: We developed a focus group guide, based on a review and comparison of recommended gold standard local and international practices for routine autism diagnostic assessments (American Academy of Pediatrics, UK National Institute for Health and Care Excellence, and Quebec's College of Physicians/Order of Psychologists). Professionals in five multidisciplinary specialist diagnostic teams were invited to participate in a 90-minute focus group (n=30). Each focus group included 5-7 professionals (e.g., clinical coordinator, psychologist, psychiatrist, developmental pediatrician, speech and/or occupational therapist) from the same care team. Focus group questions prompted information about the team's structure, the routine diagnostic assessment, feedback to families, follow-up with families, and data management.
Results: Overall, we found high consistency between gold standard recommendations and diagnostic team reports of their team's practices. The use of standardized tools was consistently used to assess phenotypic information (e.g., core autism features and developmental skills). In contrast, there was a lack of consistency in measuring psychosocial domains, such as parental knowledge of ASD and parental coping skills. The main barriers to use of standardized tools, reported by clinicians, were limited time and/or resources and linguistic and cultural diversity in the target population. Overall, there was limited systematic capture of clinical data from the diagnostic process into a database. However, two of the care teams had research registries, where a proportion of families seen in their services are enrolled.
Conclusions: We found consistency across diagnostic teams in the constructs guiding assessment of ASD, despite variation in the degree of standardization. Clinical teams do not routinely capture phenotypic data in a systematic way, making it difficult to integrate or utilize clinical phenotypic information into research. Further analysis and follow up activities are now underway to develop strategies and tools to support harmonization of processes and clinical data capture during routine services. This approach is critical as autism research moves to 'Big Data', where the inclusion of representative populations will ultimately help accelerate the integration of research findings into clinical practice. This study demonstrates that further exploration of this area could lead to long-term health system improvement.

213 **127.213** An Assessment of "Empowerment" As a Measure of the Impact of Genetic Results on Families Affected By Autism and Related Neurodevelopmental Conditions

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Background: Â Genetic tests are standard of care for children with neurodevelopmental conditions. However, genetic results entail significant complexity. Qualitative studies suggest that genetic results have variable effects on families. However, little has been done to measure the impact of genetic results on families affected by autism and related neurodevelopmental conditions, due to the lack of validated and relevant tools. Recent research in patient reported outcome measures (PROMs) has established the construct of "empowerment" to describe patient benefits from genetic services. It suggests that individuals undergoing genetic counseling have "decisional", "cognitive", and "behavioral" control, "emotional regulation" and "hope". A novel PROM, the Genetic Counseling Outcome Scale (GCOS)-24, has been developed to measure empowerment in genetics. To date, there are no studies that specifically examine empowerment in families affected by neurodevelopmental conditions.
Objectives: Â Our goal is to assess the validity of a novel tool, the GCOS-24, which measures empowerment, in families of children with autism and related neurodevelopmental conditions undergoing genetic testing.
Methods: Â Data were drawn from the ongoing prospective cohort study "ASD Genome to Outcome", assessing genetic results impact on families with autism and related conditions. Parents are invited to the study because their child has been referred for clinical genetic testing, as part of his/her routine evaluation in the context of a neurodevelopmental diagnosis, like autism. In addition to other questionnaires, parents completed the GCOS-24, as well as a measure of parental stress, the Perceived Stress Scale (PSS), and distress, the Distress Thermometer (DT), prior to receiving genetic results for their affected child.
Results: Â Data is available on 28 families: 22 (78.6%) children have autism and 6 (21.4%) have developmental delay or intellectual disability. On average, children were 5.82 (*SD* = 3.31) years of age at entry into the study. Caregiver-reported empowerment, as measured by the GCOS-24, was significantly associated with parent stress, measured using the PSS (r = -0.404, p = 0.033), but not with distress, measured using the DT (r = -0.267, p = 0.169). Empowerment was not moderated by maternal education, family income or the child's diagnosis.
Conclusions: Consistent with findings from other studies assessing empowerment in the context of routine health services, we have validated the use of the GCOS-24 for autism and related neurodevelopmental disorders. However, this measure of "empowerment" was only moderately associated with parental stress, suggesting that the GCOS-24 may also be capturing a unique construct from stress. This is the first study exploring the validity of empowerment as a measure in biomedical research of autism. It offers a methodology for the systematic evaluation of the impact of genetic results on families affected by neurodevelopmental conditions.

214 **127.214** An Examination of Ongoing Case-Based Continuing Education Model for Behavior Analysts

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Background:
There is limited research on the methods, social validity and efficacy of continuing education (CE) opportunities provided to behavior analysts. Continuing education is required of behavior analysts to maintain credentials and utilize best-practice. Given the limited data regarding CE preferences of behavior analysts, and potential impact of established CE opportunities, the purpose of this study was to examine the use of a monthly, online, Case-Based CE Model for behavior analysts working with clients with autism.
Objectives:
The objectives of this study were to examine the acceptability and efficacy (behavior analytic knowledge and intervention use), and quality (social validity) of the autism, Case-Based CE Model for behavior analysts. Data regarding: (a) types of CEs utilized, (b) acceptability of types of CEs (c) acceptability of the autism Case-Based CE Model, (d) behavior analytic knowledge (pre/post assessments) and (e) reported use of behavior analytic interventions.
Methods:
The present study is the second phase in the exploration of the Case-Based CE Model. Phase I tested the autism Case-Based CE program (n=13) with behavior analysts completing both pre/post assessments, and social validity. Preliminary results of Phase I led to the expansion of the Case-Based CE Model to examine the acceptance and efficacy of this program.
In the present study, 21 behavior analysts were selected participate in an eight month Case-Based CE Model facilitated by a panel of expert behavior analysts with autism specialty areas. During one hour, monthly online meetings, the host panel facilitated discussion of a participant-presented case, and provided information on advanced behavioral principles. Prior to and following participation in the Case-Based CE Model, participants completed a survey regarding confidence and frequency of use of 80 behavioral interventions, and, perception of the quality and efficacy of current CE opportunities. Participants completed monthly pre/post assessments relating to behavior analytic content presented. Additionally, following each session participants completed a social validity scale regarding their perception of the quality of the session.
Results:
Phase I of the Case-Based CE Model (n=13) demonstrated improvements in behavior analytic knowledge from pre-test to post-test, M= 32.7% increase. Social validity regarding the participation in the Case-Based CE Model was high following each session (5= strongly agree): relevant topic M=4.82, recommendations useful M=4.83, case concerns thoroughly covered M=4.58, addressed needs M=4.91, group participation M=4.76 and effective means to earn CEs M=4.92.
The data collection for Phase II is ongoing, (completion Spring 2017). The pre/post outcomes for content assessment and behavior analytic frequency, as well as an examination of the relationship between participant characteristics (e.g., years of experience, pre-program confidence, attendance) in relation to behavioral intervention use and content assessment outcomes.
Conclusions:
The preliminary result of this study are promising and indicate that the Case-Based CE Model may be effective in increasing participant knowledge and utilization of advanced behavioral principles and is a socially valid means to acquire CE for behavior analysts. The results of this study will generate data regarding the acceptability and efficacy of a Case-Based CE model for behavior analysts that may support future research in this area.

215 **127.215** Associations Between Family Navigation As a Care Coordination Strategy and the Receipt of Intervention Services for Families of Children with ASD within the Autism Speaks Autism Treatment Network.

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Background: Increased rates of ASD diagnoses have led to a greater need for medical services, supports and interventions during early childhood and across the life span. The challenges navigating the complex nature of the service system hinders caregivers' ability to receive appropriate and timely services and interventions for their child and family. Family navigation is one model recently utilized to coordinate and increase service access. Research on family navigation as a care coordination strategy for parents of children with ASD has received very little empirical attention.
Objectives: To examine the relationship between caregiver knowledge of a care coordinator (CC) or family navigator (FN) and receipt of behavioral and educational interventions. We hypothesized that caregiver knowledge of the CC or FN would be associated with greater receipt of behavioral and educational interventions after controlling for ASD severity.
Methods: Data on a cross-sectional sample of 564 children who participated in a longitudinal study 3 years after initial enrollment was extracted from the Autism Speaks Autism Treatment Network (ATN) registry. Measures included the total number of behavioral and educational interventions currently received (i.e. speech, OT, PT, behavior therapy, etc.), the child's age at consent, gender, race, ASD severity measured by the Autism Diagnostic Observation Schedule (ADOS), parent education, whether the family maintained any insurance, and caregiver knowledge of a CC or FN (used as a proxy for receiving CC or FN services). Covariates based on both clinical importance and statistical significance were included in the regression model testing the association between number of interventions received and caregiver knowledge of CC or FN.
Results: Results suggest children currently receive 2.88 interventions on average, and only 30% of caregivers reported knowledge of the CC or FN at their ATN site. Results of bivariate tests revealed no significant differences in the number of interventions received based on the child's age at consent, gender, race, ethnicity, or caregiver education. However, the number of interventions received was associated with insurance, ADOS severity score, and knowledge of a care coordinator or family navigator. Multivariable regression analyses showed that knowledge of the CC or FN (β=0.54, SE 0.20, $p < 0.01$ was associated with greater intervention receipt after controlling for ASD severity and insurance.
Conclusions: Â Intervention receipt among families of children with ASD varies by having knowledge of a care coordinator or family navigator, even after controlling for ASD severity and insurance. These results suggest the importance of having a designated individual to guide families as they determine appropriate services for their child and family. Future research is needed to explore whether specific aspects of family navigation predict intervention receipt in addition to other service outcomes, and whether greater service receipt reflects a positive outcome.

216 **127.216** Autism Program Environments Rating Scale (APERS): Psychometric Properties

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Background: The increased prevalence of Autism Spectrum Disorders (ASD) has created a need for providing high quality programs for students with ASD in public school settings. Although there have been limited attempts to assess quality of programs for students with ASD, none have provided evidence of the psychometric features of the assessments. In fact, the absence of a reliable and valid standardized assessment of program quality has limited program development efforts and led to litigation challenges from parents of students with ASD. The Autism Program Environment Scale (APERS) was designed to assess the quality of educational programs for students and youth with ASD. The APERS generates a summary quality rating by drawing information from 10 domains, shown in Figure 1.
Objectives: The purpose of this sudy was is to determine the psychometric qualities of the APERS. The research questions addressed are: What is the internal consistency of the APERS? What is the factor structure of the APERS? Is the APERS sensitive to changes across time when a professional development program designed to improve program quality is implemented?
Methods: The APERS is a 60+ items assessment (different number of items for different forms) that employs a 1-5 Likert rating format. Coders base ratings on observations in schools, interviews, and document review. Preschool/elementary and middle school/high school versions of the scale exist. The APERS has been collected in inclusive and noninclusive programs for students with ASD. The current study will draw from two datasets. The first set of data was collected in 76 classes for students with ASD located in 12 states, by staff from the National Professional Development Center on ASD (NPDC). Data were collected at the beginning of the school year and again at the end. The second set of data were collected in 60 high school programs located in three states, by staff from the Center on Secondary Education for Students with ASD (CSESA) only at the beginning of the school year.
Results: To examine internal consistency, Cronbach alphas were calculated. For the NPDC data set, alphas were .95 and .96 for the P/E and M/H forms. For the CSESA data set (M/H form only), alphas were .94 for inclusive programs and .96 for noninclusive programs. An exploratory factor analysis of the NPDC data yield strongest evidence for a one factor solution, which was identified as a measure of quality. This factor model was then applied to the CSESA data in a confirmatory factor analysis and yielded similar results. Also, for the NPDC data, t-tests were conducted for P/E and M/H APERS total mean item rating, indicating significant positive changes across time ($p < .01$ for both, $d = 1.28$ for P/E and $d = 1.10$ for M/H) for schools that had been engaged in a professional development project, indicating sensitivity to program effects across time.
Conclusions: Data from these studies provide evidence that the APERS is a reliable and valid measure of the quality of program environments for students with ASD.

217 **127.217** Back to School: Understanding the Path to Re-Integration for Autistic Children Who Previously Experienced Educational Exclusion

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Background:
All children have the right to receive an education and to be included in school, yet young people on the autism spectrum, who are already vulnerable to poor health and social outcomes, are at increased risk of being excluded from so-called inclusive settings. In fact, in England, over a quarter of children and young people on the autism spectrum have been excluded from education at least once. Being excluded from formal education can have drastic consequences, yet little is known about the realities of being excluded from school for autistic children and young people. There is also no research on the most effective ways for teachers to get these children back into school.
Objectives:
The aims of this project were twofold. First, we examined students' experiences in an Inclusive Learning Hub; an educational environment specially designed to increase the opportunities for children with the most complex behaviours to access education. Second, we sought to identify strategies employed by staff to improve students' well-being and re-engagement with school.
Methods:
Nine cognitively able students (8 male, mean age 13.3 years; mean non-verbal reasoning score: 97.5), all with a diagnosis of autism and the majority with a history of demand avoidant behaviour, were seen multiple times over a 6-month period to complete questionnaires and semi-structured interviews. Their parents and 20 members of teaching staff completed a battery of measures examining the students' educational experience and socio-emotional wellbeing and the researchers also observed the young people in situ.
Results:
Young people and their parents gave overwhelmingly negative accounts of their previous school experiences, which meant that these children were unable to engage in and access education and, in most cases, were permanently excluded from school. Unsurprisingly, these events often left the young people highly anxious, lacking in confidence and disaffected by school. Re-integration into school (the 'Hub') was therefore gradual, with staff making extensive efforts to attend to students' mental health needs. Despite often-traumatic educational histories, students' developed a newfound enthusiasm for school and their parents were extremely positive about the gains children had made. The Hub, seemed to provide a safe, secure environment for these young people, with dedicated staff who were highly attuned to the students' individual needs and challenges. Key strategies employed included an individualised student-centred approach avoiding the use of direct demands to reduce levels of stress and anxiety. Young people were also given greater autonomy in controlling their physical environment and daily schedule.
Conclusions:
This project contributes to a better understanding of the educational experience of previously excluded students and, critically, identifies transferable strategies for educators and those supporting these and other students, especially those with a history of demand avoidant behaviour, to ensure their well-being and engagement in learning. Future research needs both to identify the factors that place these children at risk of educational exclusion and to determine the best ways of re-integrating young people into learning environments beyond the safe space of the Hub, ensuring that they are adequately prepared for their future lives.

218 **127.218** Barriers and Facilitators to Accessing and Providing Treatment for Insomnia in Children with Neurodevelopmental Disorders: Parent and Health Care Professional Perspectives

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Background:
Sleep problems are highly prevalent in children with neurodevelopmental disabilities (NDD), such as Autism Spectrum Disorder (ASD), Attention-Deficit/Hyperactivity Disorder (ADHD), Fetal Alcohol Spectrum Disorder (FASD), and Cerebral Palsy (CP), ranging from 50-95%. Behavioural sleep problems, called insomnia, are most common. Treating insomnia is critical, as it has widespread negative effects on both child and family functioning. Although behavioural treatments for sleep problems are recommended, little research exists on parents' and health care professionals' (HCPs) insomnia-related treatment access and service utilization for children with NDD.
Objectives: To identify and explore: 1) barriers and facilitators experienced by parents of children with ASD, ADHD, FASD, and CP related to seeking, access, uptake, and implementation of behavioural treatment for children's insomnia; and 2) barriers and facilitators experienced by HCPs in accessing and providing behavioural insomnia treatment for children with NDDs.
Methods: Using a qualitative online audio/video synchronous focus group and interview design, we recruited Canadian parents of 4- to 12-year-old children with formal diagnoses of ASD, ADHD, FASD, or CP, and the HCPs who work with them (occupational therapists, clinical psychologists, developmental paediatricians, nurses, social workers, physicians, and Board Certified Behaviour Analysts). Data collection is complete for ASD groups (parent n = 20; HCP = 21), and other NDD groups will be completed in fall 2016 (target n = 7 for each of ADHD, FASD, and CP parent and HCP groups), with total anticipated N = 82 (see Table 1 for breakdown). Parents and HCPs participated separately in focus groups, following a semi-structured topic guide focusing on sleep knowledge, access to sleep treatment, and treatment uptake (parents only) or familiarity with and implementation of evidence-based treatment (HCPs only). Perceived acceptability of an online parent-directed behavioural sleep intervention was also assessed. Focus groups/interviews were transcribed and qualitatively analyzed in NVivo using conventional content analysis (coding for key themes). Comprehensive lists of barriers and facilitators were derived from the data and grouped into key theme categories.
Results: The following key themes emerged from parents and HCPs across all four NDDs: 1) Sleep problems and treatment are exceptionally challenging and intensive compared to other problems / treatment due to high impact on family, multifactorial and complex causes, need for individualized treatment, and sleep being but one of many challenges competing for parents' attention. 2) Limited awareness and knowledge about sleep and how to access help for both parents and HCPs. 3) Consistency with routines and perseverance are keys to success. 4) Sleep-related beliefs and attitudes influence parents' treatment seeking and HCPs' willingness to treat.
Conclusions: Â Contradictions were inherent in both HCPs' approach to treatment and parents' perspectives on effectiveness, with both reporting high perceived need for individualization of treatment, yet describing use of similar behavioural strategies across NDD diagnoses. This suggests the appropriateness of a transdiagnostic approach to insomnia treatment, with accommodation for NDD symptoms as needed. Results are informing the modification of an online parent-mediated intervention for sleep problems in neurotypical children,Â *Better Nights, Better DaysÂ* (*BNBD*), into an intervention for children with NDD (*BNBD-NDD*).

219 **127.219** Child Care Center Directors' Knowledge and Perceptions of Early Screening for Developmental Disabilities and Autism Spectrum Disorder (ASD)

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Background:
Early developmental and ASD screening has many benefits, including earlier diagnosis, access to early intervention (EI), and improved developmental outcomes. To benefit from EI, at-risk children must be identified, typically through screening by a primary healthcare provider, and referred for an evaluation. However, some healthcare providers do not screen for ASD, citing barriers such as lack of time, lack of knowledge, inadequate training, and hesitance to share difficult news with families. Alternatively, child care settings may be another avenue for early screening. Child care providers are in an optimal position to potentially identify at-risk children because they receive training in child development and have ongoing opportunities to monitor child development as well as build rapport with families. While recent studies show that early care professionals can be adept at screening for ASD, research has yet to provide insight as to whether Directors feel comfortable with their providers screening, talking with parents about concerns, or referring families to EI. Given their influence in decision making, examining Director's knowledge, perceptions, and practices around screening for ASD would be an important step in determining whether screening in childcare settings is feasible.
Objectives:
The current study explored Directors' knowledge, perceptions, practices, comfort level, and resources for:

1. recognizing characteristics of developmental disability including ASD,
2. screening for developmental disability and ASD,
3. communicating developmental concerns with parents and referring families to EI, and
4. continuing education in these areas.

Methods:
Twelve semi-structured interviews were conducted with Directors of child care centers serving children birth through age 5, stratified across settings (public, private, home based, faith based). Interviews were recorded, transcribed, checked for accuracy, and coded by the authors, who had established reliability on the codes. Using grounded theory, themes and axial codes (sub-themes within the data) were generated.
Results:
Director's perceptions of their knowledge of recognizing ASD ranged from minimal to moderate with all Directors interested in more training in recognizing signs and symptoms of developmental disabilities and ASD. All Directors expressed that some type of developmental *tracking process* was present at their center, however, none had an ASD screening process, and few formally screened for developmental concerns. All Directors reported feeling very comfortable or somewhat comfortable in communicating developmental concerns with parents, however, knowledge of the referral process to EI varied among Directors.Â A common theme was difficulty when parents disagreed with professionals' concerns.Â Most Directors expressed a need for training in recognizing signs and symptoms of ASD and communicating concerns to parents.
Conclusions:
This study examined the knowledge, perceptions, practices, comfort level and resources of childcare directors in identifying factors that influence formal screening, professional development, and communicating concerns with families. Directors reported that additional training is needed in screening, addressing early signs of ASD, and talking with families. Additional research investigating ASD specific screening in early care settings is warranted and identifying early care professionals' knowledge of screening can help identify gaps in practice.

220 **127.220** Collaborating with Community and Health Care Service Providers: A Community-Based Screening Program for Identifying Toddlers with Autism Spectrum Disorder

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Background: Although research has shown that we can identify toddlers with autism spectrum disorder (ASD) in their first two years of life, the mean age of diagnosis in (non-research) clinical context is still around 4 years of age (CDC, 2012). This limits the access to interventions that are most effective when offered before 3 years of age. Knowing that developmental surveillance and targeted screening for ASD could help decrease the mean age at diagnosis, collaboration between community resources and health services should be supported to implement screening program for young children with ASD.
Objectives: To explore the feasibility of a community-based screening program for toddlers (12-30 months old) with ASD and identify contextual components that facilitates or impedes its implementation.
Methods: This prospective collaborative study uses a 3-step procedure to screen toddlers for ASD in the Eastern Townships (Quebec, Canada). Step 1: Parents first completed a one page screening questionnaire depending on the child's age. Step 2: A 30-minute follow-up interview was completed with parents of children who scored at risk of ASD after the first step. Step 3: The research team completed the ADOS-T and the ADI-R with families still considered at risk after the follow-up. Descriptive analyses and predictive value was calculated separately for children aged between 12 and 18 months (group 1) who were screened via the *Infant Toddler Checklist (ITC)* and children aged between 18 and 30 months (group 2) who were screened using the *Modified Checklist for Autism in Toddler – Revised (M-CHAT-R)*.
Results: 690 questionnaires were collected at step 1. Most (67%) of the questionnaires came from the community services or daycare (21%). Of the 690 questionnaires completed, 8.4% (n=58) scored at risk of ASD at step 1, 2.7% (n=15) remained positive at step 2, and 0.44% (n=3) finally scored positive at the third step. Thus, in this study, the positive predictive value of the ITC (group 1) was 0% and 23.07% for the M-CHAT-R (group 2). Information from the clinical setting revealed an increase in children of 3 years old and younger referred to the evaluation clinic for suspicion of ASD in the Eastern Townships between the beginning of the project (8% in 2014) and the time of analysis (33% in 2016).
Conclusions: Based on the result of the pilot project, the community-based screening program should be implemented in the Eastern Townships to continue identifying toddlers at risk of ASD. However, based on the results and recommendations of the AAP Bright Futures guidelines (2016) we proposed to target specifically older toddlers (i.e. 16-30 months) for which the M-CHAT-R can be used. It is important to highlight the collaborations with partners, specifically community services and daycare that were involved in the project. A short training on early markers of ASD might be useful so that they can target children at higher risk and encourage their parents to complete the screening questionnaire.

221 **127.221** Collateral Reports of ASD Symptoms in Adults: A Preliminary Comparison of Caregiver and Clinician Ratings

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Background: ASD symptoms and psychiatric comorbidities in adults with ASD are notoriously difficult to assess. Recently, versions of the Social Responsiveness Scale, Second Edition (SRS 2) have been normed on adults. The general consensus in assessment is to obtain collateral information from other informants when possible in order to increase the validity of the assessment. However, little is known about the agreement between other-reports of ASD symptoms in adults with ASD on available assessment tools.
Objectives: To explore agreement between self-, caregiver-, and clinician-report of ASD symptoms in adults with ASD.
Methods: Fourteen adults with ASD completed a baseline assessment for a larger project examining the effectiveness of an assessment monitoring system for participants enrolled in the Adult Community Autism Program (ACAP) a state-funded program for adults with ASD. 79% were Caucasian and 93% were male. The mean number of years of education was 12.86 (SD = 1.88) and 43% reported being employed. For all individuals who reported living at home, a parent residing in the household completed the SRS 2; for all individuals who reported living alone, a support staff employed by ACAP who had been working with the participant for at least six months completed the SRS 2.
Results: Participants who lived with at least one parent and had a parent as collateral raters did not differ from participants who lived alone and had ACAP staff as collateral raters on years of education (F = 1.33, *ns*), employment status (50% were employed for wages and the remaining 50% were either unemployed or a student in each group), or race (each group was 86% Caucasian). Only one female was in the entire sample and she reported living alone and therefore had an ACAP staff as a reporter. In regards to ASD symptoms, the self-report of the two groups did not differ on any subscale. Parents rated social cognition symptoms (F = 1.10, *ns*) and restricted and repetitive behaviors (F = 2.09, *ns*) higher than clinicians, while clinicians rated social communication symptoms (F = 1.31, *ns*) as higher. At this time, these were only at trend level significance due to a lack of power. However, by February, 2017 a total of 60 individuals will have enrolled in this pilot project. The preliminary data presented within this submission will be re-run on the full dataset by May, 2017 and it is fully expected that there will be significant differences between parents and clinicians on ratings of ASD symptoms at that time.
Conclusions: The SRS 2 demonstrated a trend toward significant differences between collateral ratings of symptoms of ASD in adults enrolled in a state-funded program for adults with ASD. Caregivers of young adults with ASD rated their children higher on the SRS 2 in terms of social cognitions and restricted and repetitive behaviors than clinicians, while clinicians rated their clients higher on the SRS 2 on social communication in comparison to parents. This suggests that importance of exploring potential differences between patterns of ratings of adults' symptoms of ASD depending on the rater.

222 **127.222** Cost Evaluation of an Early Intervention Program for Children with Autism

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Background: Evidence-based early interventions for children with ASD are intensive and expensive, often consisting of 20-40 hours a week of one-to-one interaction with a skilled therapist and parents who have received considerable training. The course of early intervention can span two or more years, resulting in estimated costs of $40,000 to $80,000. Some payers, including health care insurers and state and local early intervention systems, have balked at these costs, raising concerns about the lack of demonstrated long-term improvements in functioning and cost savings. There is little evidence of economic gains associated with successful early intervention, with which to support resource allocation decisions.
Objectives: The present study will estimate the potential cost-offset of one such early intervention program for children with ASD, the Early Start Denver Model (ESDM) which is a comprehensive, naturalistic, developmental, behavioral intervention for very young children with ASD.
Methods: Data about service use were collected fromÂ the ESDM randomized controlled trial participants for both during the treatment and up to two and a half years post-treatment. These data provide a unique resource with which to evaluate the potential cost-offset of the intervention – that is, the extent to which the intervention reduces subsequent use of other services. These data allow evaluation of the relative cost of service use in two groups: one that received state-of-the-science early intervention and one that received community intervention. We will analyze data from the ESDM randomized controlled trial to determine whether ESDM treatment is associated with reduced health care and education service use and costs overÂ two and a half years immediately following intervention.
Results: N/A. Analysis is ongoing.
Conclusions: Â N/A. Analysis is ongoing.

223 **127.223** Creating Sustainable Systems of Support for Toddlers at Risk for ASD: Caregiver Perceptions and Knowledge Acquisition

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Background: According to the National Research Council (2001), early detection and 25 hours per week of active engagement promotes optimal success for young children with autism spectrum disorder (ASD) in kindergarten. Evidence-based practices such as naturalistic and parent-implemented interventions have been identified as "established treatments" for individuals with ASD (Wong et al., 2014; National Standards Project, 2015). Although most research in ASD treatment has focused on clinician-based interventions, there has been increased focus on parent-mediated interventions, as parents are the most community-viable agents of change for children at risk for ASD (U.S. Department of Health & Human Services, U.S. DOE, 2014). However, there remains a scarcity of research on the relationship between parents' ability to provide supports to promote active engagement and their own perceptions of comfort level.
Objectives: This ongoing project aims to increase knowledge of adult-learning strategies, early red flags for ASD, and supports to promote active engagement for toddlers at risk for ASD by improving collaborative coaching proficiencies of early intervention providers (EIPs) across Georgia. This investigation will focus on the relationship between caregivers' self-reported comfort and confidence in providing supports and actual level of supports provided.
Â Methods: This study is tracking the progress of 19 EIPs across Georgia, coached to coach caregivers on increasing active engagement in toddlers at risk for ASD. Coaching of EIPs is conducted in-person quarterly, with all other weekly coaching sessions occurring via technology. Effectiveness of the coach-the-coach model is assessed using SEE-KS™ (Rubin, E. et al., 2014) three-point rating scales to measure caregiver-provided supports.Â SEE-KS™ is a coaching framework based on Universal Design for Learning encompassing the principals of SCERTS® (Prizant et al., 2005).
Â Results: SEE-KS™ and Caregiver Survey values were summarized at pre- and post-coaching time points for families using means and standard deviations. Paired t-tests were employed to gauge the change in each measure for statistical significance. Results from the SEE-KS™ indicate a significant increase from baseline in supports provided by caregivers to foster engagement ($p<0.001$) and to support understanding ($p<0.001$) and expression ($p<0.001$) during the project (see Table 1). No significant changes were seen from baseline in caregiver self-reported comfort and confidence ($p=0.545$) (see Table 1).
Conclusions: Though no significant changes were seen in caregiver comfort before and after coaching, data indicate high caregiver comfort and confidence throughout the coaching process. These data also show that the current coach-the-coach model resulted in significantly increased caregiver-provided supports to promote engagement, understanding, and expression in toddlers at risk for ASD.

224 **127.224** Dbp and CBT – a Professionally Rewarding "Blend" - the Impact of Professional Collaboration on a Vulnerable Underserved Group : Children with Disabilities, Including Those with Autism Spectrum Disorders, Mental Health Challenges, and Their Caregivers

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Background:Â Mental health services are critical and frequently unaddressed, especially within the paediatric population. The World Health Organization identified both developmental disabilities and mental health disorders as significant contributors to the global health burden, especially in middle to low-income and developing countries, of which Trinidad and Tobago occupies the latter category. In the absence of locally-derived statistics, and based on international statistics from developed countries, about 20-30% of children and teenagers experience social and emotional problems that are concerning to their caregivers, with some of these being severe and clinically significant. This quantum is greater in children and adolescents with disabilities, whether simple or complex, especially if they have co-morbid chronic medical conditions. Many children and teens with "dual" mental health and somatic diagnoses, experience symptoms that are unrecognized, undiagnosed, under-diagnosed, or misdiagnosed . As a consequence, these issues remain untreated. There is no known national epidemiologic mechanism for data collection related to these issues, thus making it difficult to include these population niches within national health policy frameworks. This vulnerable population represents a major gap in our national public health system, with fragmented and/or unavailable services being the norm. Caregivers of children and adolescents with complex chronic medical issues, autism spectrum disorders, neurodevelopmental and/or behavioral issues experience higher levels of negative psychosocial stressors and have greater levels of maladaptive coping mechanisms than parents of healthy, typically developing children and teenagers. Children and adolescents with autism, are known to experience higher rates of anxiety, learning disabilities, sensory challenges and dietary atypia, which often go unrecognized.
Objectives: To develop, audit and systematically improve a collaborative and integrated model of service delivery between a volunteer mental health clinician (Cognitive Behavioural Psychotherapist) and a physician (Developmental Behavioural Paediatrician). To provide Specialist Paediatric care, Sub-specialty Developmental Behavioral consultation/support, Paediatric Psychopharmacotherapy (medication management), and Psychotherapeutic support for both child and caregiver as well as care coordination are offered by this, despite an overwhelming, persistent lack of time; and professional and material resources.
Methods: Case selection occurs from the socioeconomically, ethnically and geographically diverse clientele of a public health sector, sub-specialty paediatric ambulatory service. Clinical evaluation, case-conferencing and existing clinical evidence informs management plans, to the limit of material and human resources. Where necessary, cross-referrals are made to other disciplines e.g. Psychiatry, Occupational Therapy and to other governmental agencies, e.g. Ministry of Education.
Results: This professional synergy, despite its occurrence in a resource-poor environment, includes improvements in the insight of the child/teen and/or their caregiver(s) to their own challenges, self-monitoring (where applicable), coordinated medical, pharmacologic and mental health management; as well as application of well-known evidence-based strategies to enhance positive behaviours, to augment coping skills; personal and family resilience in chronic conditions.
Conclusions: Multidisciplinary, integrated models of care, have proven synergistic and more efficacious in the management of comorbid developmental disabilities, medical and psychiatric problems. There is potential to expand this type of service, to include other related disciplines to provide more effective service to this vulnerable niche of our paediatric population nationwide.

225 **127.225** Detection of Autism Spectrum Disorders in Children Aged 4-6 Years By Municipal Maternal and Child Health Physicians: An Educational Intervention Study

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Background: The transition into primary school at age 4 can be challenging for children with autism spectrum disorders (ASD). Due to the new demands that are made to children in this period, their limitations in social functioning and school achievements may manifest and appear faster. Detection of possible ASD signals takes mainly place by parents, teachers and during obligatory municipal maternal and child health centre visits in The Netherlands.
Physicians of municipal maternal and child health centres have limited education and instruments to detect ASD. Further education on detecting ASD is needed to optimally equip these doctors for this task. Most research aims to increase the early detection of ASD in children aged 0-3 years and shows positive results. However, there is a lack of research on educational interventions to detect ASD in children aged 4-6 years by municipal maternal and child health physicians.
Objectives: To explore the effect of the online educational intervention: *Detection of ASD in children aged 4-6 years for municipal maternal and child health physicians.* This intervention is developed within the project "Reach-Aut Academic Centre for Autism; Transitions in education", and will be available throughout The Netherlands.
Methods: Ninety-seven participants were invited to participate in the study and consisted of three sessions of each, one and a half hour duration. The sessions were offered through an online interactive classroom. The focus and content has been developed with three groups of stakeholders; autism scientists, clinical practitioners and parents of children with ASD. Outcomes consisted of: 1) knowledge about ASD: signals, early detection, communication with parents and referrals, 2) number of ASD related referrals, 3) attitude towards the mentally ill (CAMI), 4) perceived competency about ASD knowledge and detection skills, and 5) satisfaction about the educational intervention.
Results: Forty-two physicians (95.2 % female, mean age = 41.3 years, SD = 12.5) completed the intervention up till now. Participants scored on the ASD knowledge test (scored 1-10) 6,6 at start and 7,4 after the educational intervention ($p<0.01$). The perceived competence increased significantly regarding ASD knowledge, recognising signs of ASD, communicating ASD features towards parents and referring towards the proper healthcare. Physicians scored on the CAMI above average on Benevolence (M = 3.80, SD = 0.35) and Community Mental Health Ideology (M = 3.84, SD = 0.43), and below average on Authoritarianism (M = 2.16, SD = 0.35) and Social Restrictiveness (M = 2.13, SD = 0.43). Physicians rated the educational intervention with an average grade of 7.9.
Conclusions: The educational intervention *Detection of ASD in children aged 4-6 Years for municipal maternal and child health physicians* seems to be effective in increasing knowledge about ASD and perceived competence. Municipal maternal and child health physicians have in general a positive attitude towards the mentally ill. At IMFAR 2017 we will present updated results that include the complete group of participants (N=91).

226 **127.226** Early Diagnosis of ASD in Toddlers: Models to Improve Access and Wait Times

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Background: Early and intensive intervention can improve outcomes in ASD. Currently in the US, early diagnosis of ASD and access to services are delayed by long wait times. We report and discuss the results of successful ASD Assessment Processes in two different diagnostic and tertiary centers; both use a two-level ASD screening model and evaluation algorithm using the RITA-T (Rapid Interactive Screening for Autism in Toddlers) for toddlers under 39 months of age
Objectives: Improve early detection of autism with a two level screening test using the MCHAT R/F as a Level 1 and the RITA-T as an interactive Level 2 screening test, in two different diagnostic centers.
Methods: This two screening model was piloted in two different centers: a) In Calgary, with a waitlist >12 months for children under 39 months of age, a Quality Improvement Project was commenced in 2013 aimed at creating an efficient, sustainable and evidence-based ASD diagnostic process. Toddlers were initially screened by the MCHAT and the RITA-T. Three groups were created (low, moderate and high risk) depending on RITA-T and MCHAT scores. Diagnostic evaluation was completed on each group. b) In Worcester, MA, this process tested the two-level screening model completed by Early Intervention (EI) providers, and linking EI and diagnostic center for improved early screening, identification, communication and wait times. Early Intervention providers in the largest program in the Worcester area were trained with the RITA-T and on the MCHAT R/F. They screened all their toddlers already enrolled with the MCHAT and completed the RITA-T on those with a positive score and on a sample of 20 toddlers with an initial positive MCHAT but a final negative result. Toddlers were then referred for diagnostic evaluation.
Results: A) In the Calgary Group: wait improved (<28 days), evaluation processes streamlined, and validation of this process was confirmed by parents. A total of 176 toddlers were evaluated with this model. The statistical and descriptive data of the RITA-T in this model are currently being analyzed. b)-In Worcester, the study is ongoing currently; so far 90 toddlers were evaluated. Of those 75 had an ASD diagnosis. The RITA-T preliminary properties in this setting show sensitivity 0.9 and specificity of 0.85 and a positive predictive value of 0.9. Early Intervention providers relate improved communication with diagnosticians and better early detection skills and wait time to be seen is within 2 months Conclusions: A two level ASD screening model that integrates the MCHAT R/F and the RITA-T improves early detection, wait times and communication in tertiary and diagnostic centers and improves communication between Early Intervention providers and diagnosticians.

227 **127.227** Early Intervention Staff Views on Supporting Evidence Based Practice

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Background: While a range of evidence-based interventions are available to children on the autism spectrum and their families, applying these within an evidence-based practice (EBP) framework in community-based early intervention (EI) settings remains challenging. Common barriers to EBP identified through previous research include a lack of staff training, time, and workplace resources, as well as incongruences between interventions developed in research environments and clinical realities in community settings. Unfortunately, few studies have examined strategies for supporting EBP, and rarely have EI staff been consulted regarding their views on how to support their own practice, thus jeopardising the ecological and social validity of strategies developed.
Objectives: Our aim in this study was to examine EI staff views on supporting their engagement in EBP in order to identify ecologically and socially valid strategies for doing so.
Methods: We conducted a qualitative study involving five focus groups involving 29 professional (e.g., speech pathologists, teachers), paraprofessional (e.g., childcare workers), and managerial staff who worked in a community-based EI service to explore their views. The service provides a comprehensive program delivered by a multidisciplinary team to approximately 200 children per annum across multiple sites. Audio recordings were transcribed verbatim and analysed using thematic analysis.
Results: Â Two central themes, comprising six categories, emerged to account for the participants' views. *Initiative and Effort* (theme 1) accounted for the range of creative strategies staff had developed and adopted to support their use of EBP. These included methods aimed at rapidly transferring core skills to new untrained staff and ensuring clear communication between team members working inconsistent shifts to ensure continuity of care. Staff also expressed the need for *A better way* (theme 2) involving organisation-wide strategies with direct applicability for supporting staff in their use of evidence-based intervention strategies with fidelity when working in the classroom with children.
Conclusions: Â The findings demonstrate that EI staff are ideally positioned to play a key role in developing ecologically and socially valid strategies to support their engagement in EBP. In particular, the findings highlight the importance of organisational-wide models for supporting EBP, with a focus on peer-to-peer mentoring. Clinical and research implications, particularly those pertaining to the translation of research to practice in community settings, will be presented with reference to the themes and illustrated with participants' comments.

228 **127.228** Early Support Program for Autism: Bridging the Gap Between Diagnosis and Treatment

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Background: Autism Spectrum Disorder (ASD) is a lifelong condition that affects approximately 1 in 68 children and impacts many aspects of child and family life. The weeks after diagnosis can be particularly overwhelming, especially with the burden of navigating numerous treatment recommendations and diverse service systems. Many providers have lengthy waitlists, which can be frustrating for families who have been told that early intervention is critical for long lasting improvement.
Objectives: This presentation describes the Early Support Program for Autism (ESPA), an innovative community support program aimed at bridging the gap between diagnosis and treatment by providing supportive services at no cost to families after diagnosis.
Methods: ESPA is a collaboration between a large academic medical center and a local mental health agency. The primary components of the program include Clinical Care Coordination and Parent Education. The Clinical Care Coordination service is designed to help families navigate educational and healthcare systems, find relevant resources, and connect with community providers. Coordinators work with the family through an initial appointment and follow up contact as needed to provide guidance in accessing treatments and resources. The Parent Education service involves four sessions to introduce developmentally-based strategies to help parents to more effectively play and interact with their children. Sessions are offered in individual format either in-person or video conference.
Results: A total of 1100 families have accessed the program over the past three years, hearing about ESPA from other families, service providers, online, parent support groups, and flyers posted in the community. The majority of program participants (89.5%) live in the San Francisco Bay Area where the program is located, although families from surrounding areas, other states, and other countries have also reached out for support. A majority of the children (66%) are between the ages of 18 months to 7 years and most parents call within a few weeks of ASD diagnosis. However, ages of participants have ranged from 5 months to 65 years and families have connected with the program at all stages in the diagnostic process. Our analysis found that most often families request information related to accessing 1) behavior, speech, and occupational therapy through insurance, 2) special education services through the public school system, and 3) regional center services. Families have also requested lists of providers, opportunities to participate in research, information about parent support groups, and opportunities for children to connect socially with peers. Anonymous surveys of parent satisfaction indicate services were rated as excellent (86% for clinical care coordination and 98% for parent education).
Conclusions: With lengthy waitlists for diagnosis and treatment, many families are frustrated by the delay in accessing early intervention services. ESPA provides an innovative delivery model for parents to receive critical support navigating service systems as well as education to strengthen the parent-child relationship. Further research on programs such as this one will provide important insights into how providers can minimize stress and foster empowerment in the period immediately following ASD diagnosis.

229 **127.229** Educating Health Care Professionals about ASD through an Online Learning Module

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Background: The rate of associated medical conditions among youth with ASD is high, at a prevalence of approximately 40 to 60% (Coury, 2010; Kielinen et al., 2004; Liptak et al., 2006). Because of the complex presentation of ASD and other possible health needs, this patient population is likely to come into contact with various health care professionals. During hospital visits in particular, youth with ASD may require a host of specialized supports in order to deliver medical services safely, and to optimize care experiences and outcomes. Currently, there is a limited understanding of how to best support this patient population. Health care professionals (HCPs) have reported feeling ill prepared to provide appropriate care and support for patients with ASD.
Objectives: Research has shown that families face many unique hospital challenges; many HCPs and other hospital staff are not well prepared to care for youth with ASD and want ASD-specific training (Muskat et al., 2015). Therefore, the main objectives of this project were to: (1) develop and implement an online training module for hospital staff about ASD and (2) evaluate hospital staff's perceived utility of the online module.
Methods: The online module was a pilot project developed by professionals with clinical and research expertise in ASD in collaboration with the educational technology department at the hospital. Hospital staff were notified about the module through email (departmental listservs) and a notice on the hospital website. Following participation in the 10-minute module, learner feedback was solicited though a series of open- and closed-ended questions.
Results: Eighty-five participants completed the module (nurses: *n* = 28; physicians: *n* = 4; allied health professionals: *n* = 43, other: *n* = 12). Majority of participants answered the subsequent evaluation questions; however; there were some missing responses. All participants (*n* = 80/80; 5 did not complete this question) perceived the module to be easy to complete. Majority of participants (67%, *n* = 56/84) had prior ASD-focused education/training and many (64%, *n* = 41/64) had experience working with 20 or more children with ASD. Even with a sample of hospital staff that had ASD-specific experience and training, 66% (*n* = 53/80) reported that they learned something new and 85% (*n* = 69/81) reported that the module information would be helpful in their daily work. Approximately 89% (*n* = 70/79) of participants said that they would recommend it to their colleagues. Open-ended feedback was examined and revealed that participants were interested in receiving additional ASD online module training opportunities. Topics of interest included: funding issues faced by parents, hands-on behaviour management strategies, assessment and intervention strategies, summaries of current treatments and other ASD-related research, in-hospital resources, guidance for practical issues (e.g., medication adherence), guest speaker presentations, and ASD training geared specifically for protection services staff.
Conclusions: The results from this pilot evaluation have important practice implications for HCPs and other hospital staff who encounter and care for patients with ASD and their families. Next steps for this online module will be discussed.

230 **127.230** Embedded Behavioral-Health Services for Children with ASD in Pediatric Primary Care: Feasibility and Resident Training

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Background: Â Prior research suggests that behavioral health problems are diagnosed earlier and better managed when behavioral health providers are integrated within primary care settings (Chomienne et al., 2011) and that physicians report satisfaction regarding the ability to refer patients to behavioral health providers for rapid assessment and intervention (Clatney et al., 2008). Similar results were obtained when examining ASD-specific behavioral services in a pediatric primary care practice (Herrington et al., 2016). However, little research has examined similar outcomes among physicians in *training*(i.e., medical residents). Medical residents report low comfort levels regarding ASD (Broder-Finger et al., 2014), and investigations are lacking regarding residents' satisfaction and learning associated with working alongside behavioral health providers to treat patients with ASD.
Objectives: Â The current study aimed to extend previous research by (1) collecting additional information about the feasibility and outcomes associated with incorporating ASD-specific assessment and brief intervention services in a primary care clinic and (2) surveying residents who work alongside a behavioral health provider about their training experiences, perceived comfort in working with individuals with ASD, and further training needs.
Methods: A psychology provider was physically embedded in a resident primary care clinic associated with an academic medical center one day per week. The provider was available solely for providing follow-up for ASD-related concerns (e.g., failed screenings, diagnostic referrals, behavioral consultation). Data about referral types, show rates, and latency to consultation and diagnosis were used to assess feasibility and impact. In addition, medical residents were asked to complete surveys comprised of 1-5 point Likert items examining their perceptions of the benefits of the embedded psychologist; comfort level in screening, diagnosing, providing recommendations, and managing behaviors of children with ASD during appointments; and training needs. Residents' training experiences, familiarity, and comfort level specific to ASD also were compared with those related to commonly encountered medical diagnoses (e.g., diabetes).
Results: Â Preliminary data show the integrated behavioral health provider within the resident pediatric primary care clinic was able to see 75 children referred due to concerns for ASD over ten months; 33 of these children (44%) were diagnosed with ASD. It was possible to make a diagnosis within the initial consult session for 67% of the children; further testing was required for the remaining children. The latency to evaluation and diagnosis for referred children was less than two months, compared with a minimum of 6-7 months for specialty clinic assessment. Similarly, the median age at diagnosis (34 months) was considerably lower than the national average of approximately 50 months. Updated clinical data and additional data regarding resident's perceived comfort and training needs associated with working with patients with ASD will be provided in detail.
Conclusions: This study extends support for the value of embedding behavioral health services for children with ASD within pediatric primary care settings.

231 **127.231** Environmental Enrichment Therapy for Autism: Outcomes with Increased Access

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Background: While there are several behavioral therapies available for ASD treatment, these programs are inaccessible to many, are often costly, are typically less effective as patients age, are not reliably effective, and may address a narrow range of symptoms. A treatment that successfully addresses the limitations of current therapies therefore would be of great value. Two randomized clinical trials have shown that environmental enrichment can ameliorate the symptoms of ASD, but there was no evidence that this approach could ameliorate such symptoms under real-world circumstances.
Objectives: We therefore determined whether providing environmental enrichment via an online system could improve ASD symptoms.
Methods: 1,002 individuals, 1-18 years old were given daily environmental enrichment by their parents, guided by an online system, and assisted by occupational therapists, who communicated via phone or email. The parents were asked to assess the symptoms of their child with a comprehensive questionnaire every two weeks for 7 months and the therapy could be regularly customized by a computer algorithm, based on the specific needs of the child.
Results: An intention-to-treat analysis showed significant gains for a wide range of symptoms that included: learning, memory, anxiety, attention, motor skills, eating, sleeping, sensory processing, self-awareness, communication, social skills, mood, and core autism behaviors. The children of compliant caregivers had greater improvement in their symptoms than children of non-compliant parents. The treatment was effective across a wide age range and across all levels of initial symptom severity. There also was equal progress for males and females.
Conclusions: Environmental enrichment in the form of Sensory Enrichment Therapy, delivered via an online system, appears to be an effective, low-cost, accessible means of treating ASD symptoms.

232 **127.232** Evaluating Process and Impact of an Autism Intervention Training Program (AITP) for Professionals in India.

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Background: Low & Middle Income Countries (LMIC) like India lack professionals trained specifically for delivery of services to children with ASD. The few existing programs for training parents and non-specialist professionals often address discrete skills like social communication, challenging behaviors etc. There is an urgent need to create transdisciplinary resources trained to address comprehensive challenges associated with ASD across childhood and adolescence, using evidence-based practices.
Objectives: To evaluate the process and early impact of a training program in autism intervention (AITP), piloted by a not-for-profit organization in Mumbai, India for in-service multidisciplinary professionals.
Methods: A 6-month certificate program was piloted at Ummeed in Mumbai, India in 2016 to train in-service professionals in intervention approaches in children with ASD. Informed by the existing evidence base, practice wisdom, community feedback and a formal needs assessment survey, the curriculum was planned to provide participants knowledge and skills in assessment, goal planning, intervention techniques, special issues in autism and engaging families in care for children (1-12 years old) with ASD. The modular course provided information through lectures, practical experiences and on-job supervision via Skype. 12 in-service professionals, with work experience ranging from 2-25 years, representing 12 organizations, from 7 cities across India, including occupational, speech & physiotherapists, psychologists and special educators participated in the pilot.
The training program was evaluated using Kirkpatrick's Evaluation criteria. Reaction and knowledge were measured via pre-post questionnaires, video samples of work and case presentations. A qualitative approach was used to evaluate therapist perception of change in attitude & behavior and overall impact. Following a constructivist-interpretivist paradigm, in-depth interviews were conducted with 11 participants, transcribed, manually coded and analysed for content.
Results: Participants were motivated to participate due to their inability to see progress in children with ASD using existing skill sets and a desire to learn more. All participants found the AITP content relevant, useful across settings and culturally applicable. They greatly appreciated the value of post training supervision, with non-judgmental, supportive supervisor attitude and peer support. Participants endorsed the value of being taught different approaches to intervention and family centered care.
Participants in early stages of their career described increase in number of children with ASD they work with and improvement in ability to identify red-flags of ASD in undiagnosed children, engagement with families, coordination of care and overall self-efficacy. More experienced participants in positions of responsibility within organizations additionally influenced change in prevalent practices in organizations and trained co-workers, parents and teachers in schools. Parent organizations of 2 participants, catering to children with cerebral palsy in Kolkata and Chennai, started services for children with ASD post their participation in AITP.
Conclusions: This study demonstrates how local clinical and training expertise can be utilized effectively to create a structured yet broad, culturally appropriate training program in Autism intervention for in-service professionals that harnesses and builds on their existing skills. While long term impact needs to be evaluated, current findings can potentially inform development of similar training programs across other LMICs, thereby addressing the needs of multiple stakeholders in the community.

233 **127.233** Evaluation of Multiple Iterations of Government Funded Applied Behaviour Analysis Services for Children and Youth with ASD

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Background: Â The Durham Region Applied Behaviour Analysis (ABA) based-services and supports is a government funded program for children and youth with Autism Spectrum Disorder (ASD). When parents enrol their children in the program and provide written confirmation of ASD diagnosis they are placed on a waitlist; when children are discharged from the program parents are given the option to put their child back on the waitlist. Goals for the service are discussed with parents and accordingly individual service plans are developed. As a result, this program has seen children receive 1, 2 or even 3 rounds of ABA based-services since 2011.
Objectives: As part of an overall program evaluation we sought to understand the needs of the children who have received more than one round of service, and the outcomes of the service (i.e. goals achieved).
Methods: Â Data from de-identified ABA clients was extracted from the treatment centre's health information management system for services delivered from September 1, 2011 to March 31, 2016. The data for each round of service was cleaned, sorted and analyzed according to age, sex, area of concern (i.e. communication, behaviour, social and activities of daily living) and outcome of program. The outcome of the program is determined by assessing the service plan and implementing a goal achievement scale to determine if children achieved or did not achieve their goals in the allotted time.
Results: The ABA program saw 1044 individual children and youth over 5 years, of which 71.0% received one round of service, 26.0% received two rounds, and 3.1% received three rounds equalling over 1300 delivered service plans. The average age of children and youth with: one round of service was 8.5 years, with two rounds was 7.7 years, and with three rounds was 6.4 years. There were 266 children and youth who received two rounds of service, and 77.8% achieved their goals. Approximately half (51.1%, n=135) of these children received services for the same area of concern in both rounds (mostly for communication) and 79.2% whose 2nd service was in the same area of concern achieved their goals; the other half (48.9%, n=129) changed their area of concern for their second round of service and 71.3% achieved their goals. Within individuals with two rounds of service, 64% of females switched their area of concern while 46% of males did. There were 32 children and youth who received three rounds of service, and 66.7% achieved their goals. 53.1% of these children received three rounds of service for the same area of concern (majority were for communication) for all three rounds and 46.8% of children or youth changed their area of concerns and 73.3% achieved all of their goals.
Conclusions: It is unclear why children and youth are staying within the same area of concern in each round of service given the high rate of goal achievement. Future research should examine why families return to the area of concern (e.g. was there a regression or is it a new goal in that area of concern).

234 **127.234** Experiences of College Students with Autism Spectrum Disorder: A Focus Group Study

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Background: Current evidence suggests that individuals with Autism Spectrum Disorder (ASD) have more difficulty obtaining a college education than their typically developing (TD) peers (e.g., Getzel, 2008; Jorgensen et al., 2009). The U.S. Department of Education states that 35% of students with ASD who entered college completed a degree within 6 years, as opposed to 51% of TD adults (Sanford et al., 2011). It is well documented that college students with ASD may struggle with both social and organizational aspects of the college experience (White, Ollendick & Bray, 2011). However, few focus groups, interview-style studies, or case studies have been conducted to analyze the difficulties that ASD students face in college, particularly with regard to students who have attended four-year colleges.
Objectives: The primary goal of this study was to better understand the experiences of students with ASD as they navigate their enrollment in a four-year college. Questions asked were on the subject of: (1) academia, (2) socializing, and (3) available resources. This focus group was designed to evaluate the successes and gaps in four-year colleges at providing adequate support for ASD students in order to succeed.
Methods: Â Five young adults were recruited based on their self report of having received some ASD-related diagnosis at some point in their lives (including DSM-IV-TR diagnoses of Asperger syndrome and PDD-NOS) and attended at least 1 semester of four-year college. Participants came to our laboratory for two focus group sessions one week apart. Each session was two hours long and was facilitated by a licensed clinical social worker who specializes in working with college students with ASD. The investigators provided the facilitator with prompts and questions as a foundation of issues to discuss. Sessions were recorded, transcribed, and analyzed for common themes and experiences among the participants.
Results: Â The participants' conversations during the focus group were transcribed to analyze common themes among students with ASD in upper level educational institutions. Participants identified academic difficulties regarding time management, long term papers or other long-term assignments, as well as a preference to work independently rather than in groups. Multiple participants also reported feeling confused when trying to understand and interpret a professor's lecture or instructions for an assignment, and participants often did not fully understand the process of obtaining accommodations through Disability Services. Participants recommended that incoming students with ASD contact the Disabilities Services at their college before attending in order to understand the services available to them before classes begin. With regard to social aspects of college, participants reported difficulties meeting other students in classes, and perceiving their peers not comprehending or understanding their needs. In particular, participants who had roommates often reported difficulty sharing living quarters with them.
Conclusions: These results highlight common experiences among several college students with ASD who all attended different four-year colleges. They suggest a need for further evidence-based academic and social supports for college students with ASD.

235 **127.235** Exploring Differences in Autism Spectrum Disorder Symptomology By Racial/Ethnic and Socio-Economic Status

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Background:
Despite the identification of effective treatments, parents face many barriers obtaining recommended services for children with autism spectrum disorder (ASD; Benevides, Carretta, & Lane, 2016; Mandell et al., 2010). Minority and economically disadvantaged groups may experience particular difficulties receiving services. Studies examining disparities find that children from ethnic and racial minorities are diagnosed with ASD later than their White peers (Mandell et al., 2009), and suggest that Hispanic children with milder forms of ASD may be under-diagnosed (Chaidez, Hansen, & Hertz-Picciotto, 2012; Jo et al., 2015). Children living in higher socioeconomic status (SES) families are diagnosed earlier than those in lower SES families (Fountain, King, & Bearman, 2011). Minority children also begin receiving ASD specific services later than White peers (Magaña & Smith, 2013; Mandell et al., 2009) and Latino children receive fewer ASD specific services (Magaña et al., 2013).
Previous data were typically drawn from large national or statewide datasets designed to analyze the general degree of disparity across racial/ethnic and SES groups. This project seeks to limit some sources of variability by examining differences in characteristics of students served under the autism educational category in Southern California. Limiting the sample to one region likely removes discrepancies in diagnostic and treatment service quality and availability across regions and states that may be contributing to disparities identified in larger examinations.
Objectives:
To examine the symptomology of a diverse sample of public school students served under the educational category of autism to examine possible differences related to race/ethnicity or maternal education in (1) intellectual functioning, (2) ASD symptom severity, and (3) adaptive behavior.
Methods:
Participants included 279 students served under the autism educational category, living in a large, ethnically diverse area. Standardized measures of student cognitive level, ASD symptoms, and adaptive behavior were collected. Maternal education level and student race/ethnicity was collected via a demographics survey completed by parents. One-way analyses of variance (ANOVA) tests assessed mean differences observed on all measures across maternal education and student race/ethnicity. A factorial two-way ANOVA tested the interaction between maternal education and student ethnicity. Appropriate post-hoc analyses were conducted using Tukey's Honest Significant Difference method.
Results:
Results demonstrated a significant relation for maternal education level with both cognitive scores and ASD severity. Students from lower educated mothers had lower cognitive scores and more severe autism symptoms than those from higher educated mothers. A significant interaction between maternal education level and race/ethnicity on cognitive scores indicated that higher maternal education levels were associated with higher cognitive scores for White and Non-Hispanic/Latino-Other students compared to Hispanic or Latino students.
Conclusions:
These findings suggest a potential disparity in the identification of students with ASD due to maternal education level, with children from lower resource families requiring higher symptomology for identification under the autism educational category. Implications and limitations will be discussed along with future research needs to improve access to quality care for students from low resource families.

236 **127.236** Exploring the Service Needs of Families and Children with ASD: Understanding Service Type, Insurance Status, and Outcome Indicators.

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Background: Families of children with ASD utilize a greater number of services than families of children with other special healthcare needs. However, they also report more unmet needs. This is especially true for family services, such as parent-training and respite care. Differences in service access are further influenced by family socioeconomic status (SES) and insurance status. Some research suggests that families in the Medicaid system receive more services than those covered by private insurance, while others argue that this may be due to inefficient service delivery. Reported services are also affected by different service indicators, such as cost, satisfaction, or number of visits. This combination of differences makes it difficult to understand the service needs of this population.
Objectives: We aim to better understand service needs of families of children with ASD through exploratory analysis focusing on: 1) service types, 2) insurance status, and 3) service outcome indicators.
Methods: Parents of children with ASD (n=249; mean=9.7 years old) completed a demographic questionnaire and a modified version of the Services Inventory. Modifications were made based on common service needs of families and children with ASD, as well as recommendations from parents and professionals. Special attention was given to ensure that the content would be clear to low-income families receiving services within the Medicaid system. Parents were asked to indicate whether they receive, need, or do not need each of 28 common intervention, ancillary, and family support services. Service adequacy was measured as the ratio of total services received to the total number of services needed and received. Parents also indicated satisfaction with each service they receive and how they pay for their child's services (i.e., private insurance, Medicaid, or out-of-pocket).
Results: Â The relationship between all service use variables was high, indicating that parents' perceptions of service adequacy were consistent with more objective measures. Families reported receiving 8 different services on average. This represented 44% of needed common intervention services, 55% of needed ancillary services, and 37% of needed family support services, indicating unequal distribution of needs. There were also differences based on SES. Higher SES families reported greater service adequacy than lower SES families ($p<.001$, $d=.51$). Furthermore, families with private insurance actually reported higher service adequacy ($p=.002$, $d=.43$) compared to families of children with Medicaid. Across service types, privately insured families received more common interventions ($p<.001$, $d=.58$) and ancillary services ($p=.042$, $d=.30$) than Medicaid families, but there were no differences in family support services ($p=.282$, $d=.16$).
Conclusions: Despite recent changes in insurance legislation, families of children with ASD continue to face high levels of unmet needs, which are intensified by lower SES. In contrast to previous research, we found that privately insured families reported better service outcomes; however, many families reported mixed insurance status. Family-support services emerged as a primary area of unmet needs that was equal among privately insured and Medicaid families. Results suggest that overall improvements need to be made in family support services, as well as efforts to improve service access among lower SES families.

237 **127.237** Five-Year Program Evaluation of a Government Funded Applied Behaviour Analysis Program

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Background: Â Since September 2011, the Durham Region, in Ontario, Canada has been providing customized Applied Behavioural Analysis (ABA) services and supports to children and youth with Autism Spectrum Disorder (ASD) and their families. This program is available for children and youth with ASD up to their 18th birthday. This government funded ABA program is designed to be short-term and intensive (i.e. between 2 to 4 hours per week and 2 to 6 months). The clinicians, in consultation with the parents, develop goals for each child upon entry and create a unique service plan to help the child achieve these goals (using goal achievement scaling).
Objectives: Â The objective is to describe the program evaluation results of Durham's ABA-based services examining who has received the services according to age, sex, area of concern (i.e. behaviour management/emotional regulation, communication, social/interpersonal, or daily living skills.), and the outcome of service plan (goals achieved).
Methods: De-identified data on ABA clients housed in a health information management system were extracted for services delivered between September 1, 2011, and March 31, 2016. The data was cleaned, sorted, and relevant variables were selected for coding and analysis.
Results:
The ABA program administered 1373 service plans in 5 years to 1044 individual children (once a round of service is complete, parents can place their child back on the waitlist to receive another round of service); 82% were male, 18% were female, and the average age was 8 years old. The largest number of service users were between the ages of 6-10 (42.5%) followed by 0-5 year olds (31.9%). The most common area of concern for service users was communication skills (37.5%), followed by behaviour skills (28.8%), social skills and activities of daily living (27.2% and 6.5% respectively). Children aged 6-10 and 11-14 were most likely to receive services for behaviour (38.8% and 40.7% respectively), and communication was the most common area of concern for children aged 0-5 (70.3%), whereas youth aged 15-17 were most likely to receive services for social skills (45.5%). 82% of the clients achieved their goals. By area of concern, those who received services for communication were the most likely to achieve their goals (87.5%). Those age 0-5 were the most likely to achieve their goals (88.6%) and those aged 15-18 were the most likely to not achieve their goals (23.6%). The percent of males and females who achieved their goals was similar across the age groups, ranging from 77-90%, except for females in the 15-18 age range, where only 55.6% achieved their goals. Among those who did not achieve their goals, the majority (20.0%) cancelled their sessions and had difficulty fulfilling their plan (19.0%).
Conclusions: In its first 5 years, the Durham ABA-based services and supports for children and youth with ASD has demonstrated to be effective at facilitating the achievement of the goals established by the families. It is critical to understand why children and their families have difficulty with their service plans in order to best support these families.

238 **127.238** How Does Transitioning to a Mainstream 'Satellite' Class Affect the Learning, Social and Emotional Functioning of Special School Pupils on the Autism Spectrum?g of Special School Pupils on the Autism Spectrum?

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Background:
In line with international efforts to promote inclusive education, current legislation in England places a duty on local authorities to ensure that a child or young person with a special educational need or disability (SEND), including autism, is educated within a mainstream setting. The often-significant learning and behavioural needs of autistic children and young people, however, can seem to make it particularly challenging to include these children effectively within regular, mainstream schools and to obtain appropriate educational provision compared with children with other SEN. One solution may be the 'satellite' model of education where special school pupils with autism are relocated to mainstream schools but remain in separate ('satellite') classes, receiving the tailored curriculum and specialist teaching of the originating school, with access to the social and learning opportunities of a mainstream placement. There is, however, remarkably little research on the impact of transition to such satellite classes.
Objectives:
This study therefore sought to understand the impact of transitioning from an autism-specific special school to two satellite classrooms – one in a mainstream primary and another in a mainstream secondary school on the learning, social and emotional functioning of a group of young autistic people with additional intellectual disabilities and varying degrees of communicative competence.
Methods:
The current study focussed on one example of the satellite model, recently implemented by the local education authority in the London borough of Tower Hamlets, which houses a diverse ethnic population, with high levels of child poverty and special educational needs, and where many families do not have English as a home language. Questionnaires and interviews with autistic students (n = 10; 1 girl), their parents and teachers examined the academic, social, emotional and behavioural development of transitioning students and were completed twice within the space of one year – immediately before and 12 months after transition.
Results:
Overall, the young people, their parents and their teachers were extremely positive about their satellite placements and identified encouraging outcomes in terms of students' learning, behaviour and social awareness. There was considerable agreement between teachers, parents and children that fewer behavioural issues in the satellite classes were a key benefit of the transition, enabling children and young people to 'raise their game' in terms of their learning and their own behaviour. Although the satellite students and their families did not appear to be fully integrated into the life of host mainstream schools, families considered inclusion in the satellite classes as a positive outcome in itself, and some perceived a greater sense of social inclusion and acceptance for their children.
Conclusions:
This research offers unique insight into the experience of transitioning from special school to satellite classrooms in a mainstream setting, from the viewpoint of the young people, their parents and teachers. The findings highlight the benefits and also the challenges of the process and of the satellite class model itself – a potentially promising model for educating children and young people in England.

239 **127.239** ICF-CY Domains of Importance for Parents of Young Children with Autism Considering Treatment Outcomes and Quality of Life: Family-Centered Beyond Professional-Child Intervention.

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Background:
Early Intensive Behavior Interventions (EIBI) that foster Parent Inclusion distinguish in the professional's role to support the family to identify challenges to participation, and to instruct in ways that built child and family capacity. The International Classification of Functioning, Disability and Health - Children and Youth version (ICF-CY) framework support professionals consideration of parental perspectives on children's Activities, Participation and Environmental Factors associated with EIBI.
Objectives:
This action research from Italy sought to (1) employ ICF terminology in categorizing the concerns and goals regarding EIBI based on a preliminary autism core set, (2) develop an extended schedule of the instrument to assess severity-related parent treatment priorities, (3) to document the association to perceived family Quality of Life, and (4) to assess the rate of agreement in treatment priorities based on child skill performance between parents and professionals.
Methods:
Through an action research process, 20 parents of preschoolers with autism spectrum disorders who received EIBi intervention with active Parent Inclusion provided ratings of parent Quality of Life (WHOQOL-BREF, WHOQOL group, 1998), child functioning (ICF-CY developmental code sets and autism-specific ICF-CY components, Castro et al., 2013; Boelte et al., 2016), and assigned each a measure of treatment priority. Each ICF-CY profile was analyzed by two clinicians, a neuropsychologist and a clinical supervisor, and clinically chosen treatment priorities assigned. A total of 130 ICF-CY categories were included. For analysis categories relevant in at least 30% of the cases were retained and reported as follows.
Results:
The resulting schedule retained N=69 items of parent concerns were distributed mainly across ICF-CY Activity and Participation (44 items), less across Body Functions (29 items) and Environmental Factors, (5 items). Parental concern and treatment priority varied with the content of unit analyzed with parents focussing mainly on psychosocial and communication functions. In addition parents demand high support priorities in managing health and social service systems and policies. In choosing treatment priorities parents apply a deficit-based selection approach coherently with high priorities where child's abilities are lacking. Clinicians priority interrater agreement was high (kappa range .07 to .08), while parent - clinician interrater agreement was small to moderate (kappa range .04 to .06). A quadratic relation was found for child performance and clinician treatment priorities. Clinicians apply a strength - based approach to priority selection were basic skills are present and a deficit-based approach in major deficit areas that are defined teaching barriers (such as imitation, attention). Family Quality of Life was negatively impacted by poor child performance in communication, major life areas and handling demands , as well as lacking services that meet the child's needs.
Conclusions:
The results indicate that (a) a functional perspective added to diagnostic indicators may inform intervention practices, and (b) environmental factors such as the professional-family rapport impact family Quality of Life and thus intervention outcome. We found that parents follow a need-based logic in treatment expectations, whereas professional treatment planning mainly incorporates a strengths-based logic following the notion of proximal development.

240 **127.240** Impact of Household Income and Urbanicity on School Services

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Background: Access to an appropriate educational setting is a priority for families of children with autism spectrum disorder (ASD).
Objectives: (1) To determine how school type, school services, and suspension rates for children with ASD are associated with household income and urbanicity (as determined by surrounding population density). (2) To determine whether emotional, academic, and special needs of children with ASD are being met in the school system by household income and urbanicity.
Methods: Â Parent participants in the Interactive Autism Network (IAN)— a large, validated and verified, internet-mediated parent-report research registry—completed the School Service Questionnaire (SSQ) on their child(ren) with ASD. The SSQ asks questions regarding special services, school placement, suspension and drop-out rates, and satisfaction with school services. Data from the IAN registry regarding participants' household income and urbanicity (using the 2013 NCHS Urban-Rural Classification Scheme for Counties) were also included in the analysis.
Results: Parents of 1774 children with ASD (79.9% male) completed an online survey on school services as part of a series of baseline questionnaires for the Interactive Autism Network (IAN). The data revealed that urbanicity (urban, suburban, small-medium metro, rural) was significantly related to use of certain special services such as behavior therapy ($X^2(3)=9.12$, $p=0.028$), assistive technology ($X^2(3)=13.68$, $p=0.003$), applied behavior analysis ($X^2(3)=14.34$, $p=0.002$), and social skills training groups ($X^2(3)=13.37$, $p=0.004$). Each of these services was more common in suburban areas compared to urban, small-medium metropolitan, and rural areas. Household income was also significantly related to the use of social skills training groups: families in the third and fourth income quartiles were more likely to use this service ($X^2(3)=9.85$, $p=0.02$). School placement was significantly affected by urbanicity ($X^2(12)=39.34$, $p<0.001$), with home school and public school being more common in rural settings, and private/non-public, specialized private, and specialized public being more common in urban settings (see table 1). In terms of income, 69.2% of children in all household income quartiles were in the public school system. However, there were significant differences by income quartile ($X^2(12)=55.12$, $p<0.001$) as to where the remaining children attended (see table 2). Higher suspension rates were significantly associated with smaller urbanicity settings ($X^2(3)=13.286$, $p=0.004$), but suspension rates did not significantly differ by household income. Lastly, parents' satisfaction with school services meeting their child's emotional, academic, and special needs significantly differed by household income, with higher income quartiles having generally higher rates of satisfaction. Parent satisfaction, however, did not differ by urbanicity.
Conclusions: There are discrepancies in the use of special services, school placement, suspension rates, and level of satisfaction with school services based on urbanicity and household income. These findings point to the need for better educational access for children with ASD who come from less-resourced settings.

241 **127.241** Improving Diagnostic Capacity for Autism Spectrum Disorder in a Developing Country: A Model Public/Non-Governmental Organization (NGO) Partnership Program

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Background:
Accurate identification and treatment of autism spectrum disorder is considered a critical public health challenge even in well-resourced communities. In a developing country, the ability to actualise better services is further limited by resource challenges regarding funding, management support, political support, infrastructure constraints, and the limits of human resources. While clinical practice recommendations for identification/diagnosis of ASD support the use of structured/standardized tools, these tools and supportive training opportunities for use are often lacking with limited financial support available across resource strained public health systems. The current project utilized external funding support from a NGO to train professionals within the public health system to utilize standard tools for screening and diagnosis of autism.
Objectives:
We studied the impact of a NGO sponsored training in altering practice within the public health system for physicians, psychologists and therapists.
Methods:
In April 2015, a local Rotary Club, a Child Health Department of a tertiary institution, a Community Paediatric team in a Regional Health Authority (RHA) and the Training Department of the RHA came together to host training in specialised tools used for screening and diagnosis of Autism (Screening Test for Autism in Toddlers, STAT, Autism Diagnostic Observation Schedule-2, ADOS-2). In parallel a steering committee comprising all stakeholders was formed to discuss impact, use, and future directions. The project funded by the Rotary Club sponsored formal ADOS-2 and STAT training by a certified trainer from an external U.S. based university. The Training department of the RHA and the Rotary club worked together to oversee the administration of the project. The training was carried out in a public teaching hospital. Professionals trained included doctors, psychologists and therapists.
Results:
23 professionals comprising 2 child psychiatry and 2 child development services within the public health service received ADOS-2 training. 42 professionals representing all 5 RHAs received STAT training. In the year following training, some 42 ADOS-2 assessments and 75 STAT assessments of young children were conducted within the public health system with 3 out of 5 represented regional health authorities (RHA) incorporating use. In addition, the NGO investment led to an additional joint partnership supporting provider training in an evidenced-based parent training program. Subsequently, within the calendar year following training 60% of RHAs held parent training sessions for local families.
Conclusions:
In keeping with the United Nations mandate for upgrading services for Autism this Public/NGO partnership has served to bolster our capacity in a developing country. Given the constraints, financial and otherwise, this type of partnership may the way forward in developing countries. While the partnership has bolstered capacity and spurred additional collaborations, further supports and strategies beyond just provision of training and instruments is necessary to achieve wide-scale systems change and improvements in care within developing countries.

242 **127.242** Increasing Use of M-CHAT-R/Follow-up in Pediatric Care through Clinician Participation in a Maintenance of Certification Quality Improvement Project

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Background: Â The American Academy of Pediatrics recommends that all children be screened for Autism Spectrum Disorder (ASD) at ages 18 and 24 months using valid tools. Screening for ASD is critical for earlier identification and intervention to improve outcomes, yet routine screening is not uniformly implemented. Many practice-level barriers prevent the efficient and timely use of recommended ASD screens such as the Modified Checklist for Autism in Toddlers-Revised with the required Follow-up Interview (M-CHAT-R/F). These barriers to screening are often the target of Quality Improvement (QI) projects in pediatric care. Part 4 of the American Board of Pediatrics (ABP) required physician Maintenance of Certification (MOC-4) program—Improving Professional Practice—aims to increase physician knowledge of quality improvement methods and engagement in QI projects to improve care. One accredited MOC-4 program offered through the Center for Promotion of Child Development through Primary Care targets barriers to routine ASD screening among physicians using the affiliated web-based platform CHADIS, which supports developmental screening, clinical decision making, and patient engagement in pediatric care.
Objectives: Compare 6-month baseline average M-CHAT-R/F screening rates to 6-month post-MOC QI project rates to assess influence of physician participation in an MOC project on improving ASD screening.
Methods: All physicians enrolled in this MOC QI project completed a 10 minute online educational module on autism screening, diagnosis, and intervention. Physicians also met with coaches monthly for one hour to identify barriers to screening in his/her practice and plan QI activities to overcome them using the Plan-Do-Study-Act framework. Coaches reviewed run charts tracking the impact of QI activities on ASD screening rates with physicians. To assess practice-level impact of MOC-related QI activities, the number of M-CHAT-R/Fs completed using the CHADIS system was examined for the 6 months prior compared to the 6 months following MOC enrollment.
Results: MOC participation and M-CHAT-R/F screening data was analyzed from 138 clinicians representing 47 practices ranging from solo practitioner to multi-physician hospital settings across the U.S. On average, these physicians reported 24 years of clinical experience. Before MOC participation, 71% reported routinely screening for ASD at ages 18 and 24 months. Many barriers to appropriate use of the M-CHAT-R/F were identified, including inefficient office workflows, failure to administer follow-up interviews for all positive screens, and limited task-sharing and communication between clinical support and administrative staff. In the 6 months prior to MOC enrollment, an average of 21 M-CHATS-R/Fs were completed per month across practices. After MOC enrollment, the average number of M-CHAT-R/Fs completed in the CHADIS system increased to 30 per month, a 43% increase. Percent change in screening between baseline and follow up was positive among all enrolled practices and ranged from 12% to 180% increases in screening after implementing the Plan-Do-Study-Act QI framework and tailored improvement activities.
Conclusions: Physician participation in the MOC-4 quality improvement project offered through CHADIS increased rates of M-CHAT-R/F use across a 6-month period. Future projects engaging physicians in quality improvement at the practice level should be considered to reduce barriers to implementing routine ASD screening in pediatric care.

243 **127.243** Initial Efficacy of Primary Care Stepping Stones Positive Parenting Program on Reducing Risk of Dysfunctional Parental Discipline of Children Newly Diagnosed with Autism Spectrum Disorder

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Background: Dysfunctional parental discipline practices have been implicated in the development and maintenance of disruptive externalizing behaviors by young children. Parents of children with autism spectrum disorder (ASD) commonly experience more disruptive behaviors from their children compared to parents of children without disabilities. Primary Care Stepping Stones Positive Parenting Program (SS-Triple P), a personalized, parent-mediated intervention that targets disruptive behaviors in their children newly diagnosed with ASD through the promotion of positive parenting practices.
Objectives: To investigate whether participation in a brief, one-to-one parenting intervention designed to target discrete problem behaviors impacted the disciplinary styles of parents of children newly diagnosed with ASD.
Methods: A two-group, pre- and post-test, open trial design with random assignment to intervention (N=12) versus wait list control (WLC, N=9) was administered. Patients were recruited from an urban Midwestern Autism Speaks-Autism Treatment Network diagnostic clinic and surrounding community. Child inclusion criteria included receiving a DSM-V ASD diagnosis in the past year from a physician or psychologist, age between 2 and 12 years, and demonstrating moderate to severe behavior problems (Eyberg Intensity T-Score>60). Parental discipline was measured using the Parenting Scale (PS), by Arnold, O'Leary, Wolff and Acker (1993) (α=0.86). This 30-item questionnaire measures dysfunctional discipline styles in parents by asking about the probability with which the parent uses particular discipline strategies. All 30 items are scored on a 7 point Likert scale, with low scores indicating good parental discipline and high scores indicating dysfunctional parental discipline. The Parenting Scale yields a Total score and three factors: Laxness (permissive, inconsistent discipline); Over-reactivity (harsh, emotional, authoritarian discipline and irritability); and Hostility (use of verbal or physical force).
Results: Â Parents who received 4 weeks of Stepping Stones Primary Care Triple P had a PS Total Score that on average was significantly lower than the PS Total Score of parents who had not yet received Triple P: $F(2, 19) = 8.33$, $p < .01$; Wilk's $\Lambda = 10.709$, partial $\eta 2 = .31$. In addition, parents who received 4 weeks of Triple P had significantly lower measures ofÂ Over-reactivityÂ than the parents who had not yet received Triple P: $F(2, 19) = 4.95$, $p < .05$; Wilk's $\Lambda = 0.793$, partial $\eta 2 = .21$. No other subscale produced statistically significant findings.
Conclusions: Â Initial results from this pilot study show that a brief, parent-mediated intervention for parents of children with ASD can bolster functional parental discipline styles and help parents avoid and reduce dysfunctional parental discipline styles. Specifically, parents who participated in the Triple P intervention were less likely to report using harsh, irritable, or authoritarian discipline compared to parents who had yet to receive the Triple P intervention. Because harsh discipline can exacerbate child behavior problems and because children with ASD commonly display some externalizing behaviors, interventions which bolster and reinforce good parental discipline strategies are important for families with children with ASD. Primary Care Stepping Stones Triple P is a brief (4 session) intervention that can improve parental discipline and be used long after treatment is complete.

244 **127.244** Interdisciplinary Team Evaluation: A Cost and Time Effective Method for the Clinical Assessment of Autism Spectrum Disorder

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Background: Diagnostic evaluations for autism spectrum disorder (ASD) follow a range of processes that can be lengthy and contribute to long wait times for an evaluation. Focusing on essential features of diagnostic evaluations may create a more streamlined process at diagnostic centers, thereby alleviating wait times. At the Seattle Children's Autism Center (SCAC), we developed an interdisciplinary team evaluation model with two providers of different disciplines, allowing two patients to be evaluated in a single day (Figures 1 and 2). We previously reported commensurate family satisfaction and ASD diagnostic rates across three evaluation models: Team evaluation, Psychology only, and Physician only (Gerdts, et al., 2016). However, differences in actual reimbursement rates and billing times have been unexamined.
Objectives: To compare reimbursement rates and billed hours in Team evaluations versus more traditional ASD diagnostic evaluation methods.
Methods: Sixty-one patients who completed diagnostic evaluations at the SCAC were randomly selected to examine actual reimbursement amounts and billed time for full diagnostic evaluations (excluding an initial triage appointment). Patients were evenly distributed across evaluation types (n=18 for Team, n=21 for Psychologist, and n=22 for Physician). Fifty-three percent of patients had Medicaid and 47% had a commercial insurance plan, with no differences in insurance types across evaluation types (p=.94). Billed hours were determined by summing the time implied by the billing codes associated with the diagnostic evaluation. Net clinic hourly income for evaluations was estimated by calculating the difference between hourly reimbursement rates and average hourly salary rates for provider types at SCAC in the various evaluation tracks.
Results: Given the large discrepancy between Medicaid and commercial insurance reimbursement rates for evaluation, (t(59)=-6.57, p<.001), insurance type was entered as a covariate in analyses of variance. After controlling for insurance type, there were no significant differences in reimbursement rates across diagnostic tracks (p=.59). However, there were large differences in billed time, F(2, 58)=28.35, p<.001 with Teams billing significantly fewer hours than Psychologists only and significantly more than Physicians (Mean=4.5, 6.2, 3.0 hours, respectively for Team, Psychologist, and Physician tracks, p<.005). After controlling for insurance type, there were significant differences in hourly net income across diagnostic tracks, F(2,57)=29.39, p<.001, with highest clinic income for the Physician track (Mean net income=$142.49 per hour), followed by Teams (Mean=$92.37), followed by Psychologists (Mean=$24.30).
Conclusions: ASD Interdisciplinary Team Evaluations appear to be an efficient method for completing ASD diagnostic evaluations while still incorporating gold standard diagnostic tools (e.g., ADOS-2, caregiver interview), without detriment to family satisfaction and while maintaining consistency in diagnostic rates (as reported previously, Gerdts, et al., 2016). Team evaluations result in significantly fewer billed hours (nearly 2 hours less) than a traditional psychology-only evaluation, and generate more income relative to average provider salary when taking actual reimbursement rates into account.Â In ASD diagnostic centers employing a variety of providers, team evaluations focusing on ruling-in/ruling-out ASD may be an efficient and cost-effective method for conducting ASD diagnostic evaluations, likely beneficial in decreasing wait times thus expediting family's access to services that are often contingent on an ASD diagnosis.

245 **127.245** Living up to the Ethical Obligation to Secure the Rights of Individuals with Autism in Developing Countries

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Background:
Following World War II the United Nations Assembly, backed by 47 nations, enshrined key aspirations such as dignity, equality, freedom and respect in the Universal Declaration of Human Rights to, at a minimum, guard "against tyranny and oppression" (p. 71, Section 217 A, para.3). Since then, more than 70 treaties, including the Convention on the Rights of Persons with Disabilities (United Nations, 2006), have been signed to further secure these inalienable rights for "vulnerable" populations. Yet, according to a 2011 report by the World Health Organization these basic provisions continue to elude most of the world's 1 billion people with disabilities (most of who live in the developing world). Their progress is continually hindered by attitudinal, financial, and/or physical barriers in key social institutions.
Objectives:
The purpose of this conference discussion is to engage an interdisciplinary audience to contemplate the following question: What would it take for developed countries to share their expertise and resources with key constituencies in developing countries in order to positively impact the outcomes of children with autism?
Methods:
The impetus for this question stems from a service learning work experience in one resource limited country, Barbados that lead the authors to lead a series of workshops for parents of children with autism . These parents sought the knowledge, the expertise and key understandings about how to direct the inner lives of their children, and if they to have been provided adequate resources and training, would be able to do much more on behalf of the children and families with autism.
Results: N/A
Conclusions:
The authors hope that the question they pose for discussion would generate ideas for collaborating to both develop studies and outreach programs aimed at assisting parents and educators of children with autism in less resource-rich countries where access to well-established therapies and resources are scarce !

246 **127.246** Measuring Person Centred Outcomes for Autistic Adults in Receipt of Social Care – Lessons and Results from a Nationwide Study.

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Background: Many autistic adults receive social care (human services). This care is often publicly funded. Autistic adults and their families have a right to expect the care to lead to positive outcomes. The evidence base for how most effectively to provide this support is poor. Hence suitable outcome measures are needed. Previous attempts at measuring outcomes for autistic people have largely been based on the subjective views of researchers, or lengthy questionnaires which many autistic people have difficulty completing. Barriers to establishing outcome measures include: the costs and burdens which measurement processes impose on services and the people they support; the varying priorities of autistic people, and the importance of not imposing social norms on them; the varying levels of intellectual disability among autistic people and the forms of communication which they employ; and the range of stakeholders' expectations (autistic people, their families, commissioners of services, regulatory bodies, policy makers, service staff).
Objectives: This study was conducted by a leading nationwide charity for autistic people and their families. The study's objectives were (1) To consult each stakeholder group on the outcomes most of interest (2) To review existing approaches and their suitability for adults in receipt of social care (3) To test existing and new approaches in a cross-section of service settings.
Methods: The study comprised an international literature review of outcomes for autistic people; a nationwide review of existing approaches within the charity and among other autism charities and social care providers; focus groups and interviews with autistic people, families, social care staff and managers; a nationwide survey of 6,000 autistic people and their families; pilot fieldwork in a cross-section of service settings using questionnaires and observational methods; testing of recording systems; use of independent researchers; and analysis of administrative data held by the charity. The study received approval from the research ethics committee of an external publicly funded body.
Results: No single outcome measure was found that addresses all stakeholders' expectations. Safety, quality of family life, achievement of meaningful goals, reduced support needs, and societal benefits collectively go some way to meeting their evidence needs. No existing instruments or approaches were found that proved workable on a large scale in a social care setting. In particular multi-dimensional Quality of Life measures, even if adapted for people with an intellectual disability, have some use in goal setting but are too broad and abstract for use with many autistic people. Autistic people may also find them patronising or intrusive.
Conclusions: An effective outcomes framework for adult social care for autistic people should comprise a range of measures, primarily tailored to the individual and also if possible addressing other stakeholders' priorities. Although goal setting should be person centred, standard outcome measures which can be aggregated are preferable for benchmarking and evaluation. A mixture of observation, administrative data and fieldwork is needed. Outcome measures should not only be reliable and valid but also fulfil more practical and autism specific criteria such as being low burden, person centred, and flexible.

247 **127.247** Measuring the Social Return on Investment from Progression Support for Autistic Adults – Lessons and Results from Case Studies.

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Background: Autism is a lifelong condition experienced by a significant and possibly increasing proportion of the population. The direct financial cost of supporting autistic people and their families is significant. Outcomes for autistic people in adulthood are on average worse than for the rest of the population. Hence the wider economic and social benefits to society of providing support which leads to improved outcomes are also likely to be significant. Applying a Social Return On Investment (SROI) approach to interventions for autistic adults is a potentially informative way of understanding the balance of costs and benefits to society.
Objectives: The project's objectives are to assess (1) the applicability of SROI concepts to services for autistic adults (2) identification of autism specific issues necessitating modification of the SROI approach (3) the practicality of collecting longitudinal SROI data in a frontline service setting (4) the value and insights which the autistic adults, service managers, commissioners and other stakeholders derived from the resultant SROI estimates.
Methods: This project takes place within three geographically separate services operated by a leading nationwide autism charity. Each service was chosen because its focus is to support autistic adults in achieving progression towards a life course goal – for example successful transition into adulthood, or progression towards sustained, unsupported employment. A review of SROI approaches in government and the third sector was undertaken. A longitudinal dataset of service fees was constructed to quantify financial costs and identify individuals with apparently changing support needs. With individuals' consent, input data and contextual information was collected via interviews and case notes.
Results: Autism professionals, autistic people and their families generally agreed with the validity and relevance of the SROI approach. When case studies are completed, feedback will be sought from stakeholders on the insights they bring. Significant changes over time in individuals' service fees were less common than expected, suggesting that achievement of life course goals is rare, though further investigation may identify other factors that explain this finding. Autistic adults in receipt of these services often had a poor employment history, accessed health and social care frequently, andÂ some wereÂ in contact with the criminal justice system. This suggests there is high potential SROI which can be realised if services prove effective for at least some individuals up to a 'break even' point which the project will attempt to estimate.
Conclusions: The SROI approach appears to be applicable to services for autistic adults and of value to stakeholders. There are some challenges including the difficulty autistic people may have with recall or intrusive questioning; the often slow and uneven progress achieved towards outcomes; and the complexity of SROI calculations for untrained service managers. These challenges can potentially be overcome if a professional analyst is engaged, processes are co-produced with autistic people, and periodic data collection is built into the support planning and reviewing process.

248 **127.248** Mixed Method Feedback on the Integration of Parent Engagement Strategies into an Evidence-Based Parent Coaching Intervention for Young Children at Risk for ASD

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Background: Parent meditated interventions have numerous positive effects on child/family outcomes and can provide intensive, daily intervention (Burrell & Borrego, 2012). These interventions require active parent engagement (service initiation, attendance, and participation; e.g., Haine-Schlagel & Walsh, 2015). Studies have suggested that specific provider approaches, such as parent-professional collaboration and problem solving, can facilitate parent engagement (Brookman-Frazee, 2004; Burrell, 2013). Little is known about how child-focused providers will perceive training specific to parent engagement, in particular as part of an evidence-based parent coaching intervention for children with ASD.
Objectives: The current study used mixed qualitative and quantitative methods to characterize provider perspectives on parent engagement strategies that were integrated into training on an evidence-based parent coaching intervention for young children at risk for ASD (Project ImPACT for Toddlers or PI for T; Ingersoll & Dvortscak, 2010). The engagement strategies, referred to as Alliance, Collaboration, and Empowerment (ACEs), were adapted from a toolkit initially designed for child mental health services (Haine-Schlagel et al., 2016)
Methods: Agencies serving toddlers with ASD were invited to participate. The first 15 agencies to respond identified an agency leader to learn PI for T and become an agency trainer (AT). Training was delivered over 12 weeks and included two sessions focused exclusively on ACEs. After an additional three months utilizing PI for T independently, ATs received a feedback survey (responses on five-point scale; 1=strongly disagree and 5=strongly agree) and were invited to participate in an interview by someone not involved in training. The survey and interview guide included several questions specifically about ACEs, which are the focus of this study. Data presented are from the first eight ATs to complete both the survey and interview. ATs were 87.5% female. Modal age range was 36-40; 25% were Hispanic/Latino. Average years of experience was 9.5 (range 4-28); 25% had a PhD and 75% had an MA/MS. Data collection is ongoing and will be completed by the end of 2016.
Results: Quantitative survey data and qualitative interview data were examined using complementarity (i.e., quantitative provides breadth/qualitative provides depth; Palinkas et al., 2011). Quantitative data were analyzed using descriptives in SPSS; qualitative data are preliminary and currently being analyzed using a Rapid Assessment Process (Beebe, 2001).
Quantitative data (across 3 items) indicate that ATs felt ACEs training was valuable (M=4.125; SD=.711; range 3-5), which was consistent with a complementary qualitative theme that providers found ACEs useful in helping parents and providers work together and found the training materials useful in learning to implement ACEs. Survey results (1 item) also indicated that ATs used ACEs with other families they serve (M=4.375; SD=.518; range 4-5), which was consistent with a complementary theme indicating that ATs used ACEs with other families and planned to train other providers to use ACEs.
Conclusions: Both quantitative and qualitative data indicate that early intervention service providers consider training on parent engagement strategies to be useful and generalizable in their practice. Future research can examine whether parent engagement strategies used by providers improve both parent engagement and child outcomes.

249 **127.249** Mobile-Health to Enhance Parent-Mediated Intervention for Children with Autism Spectrum Disorder in Vietnam: Process of Development and Lessons Learnt

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Background:
There is some evidence for the effectiveness of parent-mediated intervention model, in which parents can learn the necessary skills to deliver therapies for their children. This is particularly important in settings where there is a dearth of qualified early childhood interventionists and allied health therapists such as in low and middle-income countries. With the fast development of the internet and mobile phone uptake, using m-health to improve parents' knowledge and skills is considered as having the potential to bridge the disparity of services.
Objectives:
This presentation will present the process of developing a web-based platform (a365.vn, and responsive to mobile devices) to support Vietnamese parents to undertake early intervention for their children at home, as well as lessons learnt from piloting this model.
Methods:
Data for this presentation came from project reports, back-end data of web-based platform, interviews with parents during users testing, monitoring and evaluation, and reflections within research team.
Results:
With financial support from Grand Challenges Canada, a365.vn has been developed and improved through several steps (formative research, user's testing, content development) and with the involvement of professionals from different disciplines and especially parents (end-users). A365 provides key strategies for parents to do intervention with their children, modeling videos to support parents to teach their children specific skills, and short questionnaires for parents monitoring progress of their children. By end of September 2016, forty one modeling videos have been made available for parents to use with a log-in account and password protection; 425 care givers from 47 provinces (out of 63 provinces in Vietnam) used a365 for intervention, especially a number of users from locations where limited services are available for children with ASD. Parents considered this web-based platform as a good resource to build their capacity in teaching their children, and enhance their children skills and ability. However, a number of parents did not consider themselves capable of providing intervention and found some challenges when use a365. They also expressed their needs of having more modeling videos, instruction, and coaching.
Conclusions:
M-health is potential for increasing access to services for children with ASD. It is an evolutional process and requires strong engagement of end-users and multi-disciplinary collaboration in order to be a friendly and effective product for users. Coaching and motivating parents is important.

250 **127.250** Multidisciplinary Evaluation for ASD in a Clinical Setting

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Background:
Best practice guidelines for autism assessment call for a comprehensive evaluation including the following components: parent interview, review of relevant records, cognitive/developmental assessment, direct play observation, adaptive assessment, and comprehensive medical examination (National Standards Project, 2015). As an autism specialty clinic, we have followed these guidelines in our diagnostic protocol; however historically the medical evaluation occurred only after the autism diagnosis had already been made by a psychologist. There are many problems with this approach. By delaying the medical evaluation to the end of the diagnostic process, important medical information will not be incorporated into the diagnostic formulation. Neurological disorders that better account for the developmental concerns, e.g. cerebral palsy, or medical conditions that preclude a diagnosis of ASD, e.g. profound visual or hearing impairment, will be missed. When medical conditions are not taken into proper consideration, inappropriate behavioral assessments are utilized and underlying diagnoses are conceptualized incorrectly.
Objectives:
The objective of our current initiative is to meet best practice guidelines through an integrated multidisciplinary approach, which includes incorporating medical and behavioral assessment findings in the conceptualization of each child's diagnosis.
Methods:
In the new diagnostic model, patients are first seen by a medical provider (child neurologist, developmental-behavioral pediatrician, child psychiatrist, or pediatric nurse practitioner) who conducts a parent interview, reviews medical records and performs a physical examination.Â When significant red flags for autism are present and medical/neurological conditions do not account for the developmental delay, children are referred on to a psychologist for a comprehensive evaluation of behavioral symptoms. After psychological testing is completed, the physician/nurse practitioner(NP) and psychologist confer to conceptualize the case and determine diagnosis, followed by a joint feedback session with the family.
Results:
Multidisciplinary evaluations were rolled out as a pilot in our clinic in May 2016. Patients participating in this pilot identified as White (58%), Black/African American (32%), Asian (5%) and Other (9%), and 59% had Medicaid as their primary insurance. A total of 85 patients received a diagnostic interview with a physician/NP. Of these, 38% were not referred on for additional testing (ASD ruled out for 18%, and clear ASD already established for 20%). 15% of the patients had significant medical conditions (e.g. congenital CMV, agenesis of corpus callosum, sensorineural hearing loss, complex congenital heart disease). Of the children who were referred on for comprehensive psychological assessment, 72% met criteria for ASD.
Conclusions:
Autism spectrum disorders can be very challenging to diagnose, particularly in young children, as other neurodevelopmental disabilities can have similar presentations. An autism diagnostic assessment requires a comprehensive evaluation, ideally in a multidisciplinary setting. Both medical and behavioral assessments should be thoughtfully integrated to inform diagnostic formulation. Experts from different fields who are well trained in ASD assessment should work collaboratively to establish a diagnosis of autism in order to develop more comprehensive care plans that take all aspects of the child's profile into consideration. Future plans for multidisciplinary diagnostic assessment involve expansion of expertise to include professionals in speech language pathology, nutrition, and clinical genetics.

251 **127.251** Multimodal Study Using Geospatial Mapping and Survey Analysis to Determine Disparities in Access to Care for Children with ASD

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Background: Among individuals with Autism Spectrum Disorders (ASD), disparities in access to healthcare have been linked to low socioeconomic status, racial and ethnic minorities, and residence in rural and under-resourced areas. However, little is known about the specific barriers individuals with ASD face in accessing care and the impact of specific geographic locations. The Autism Treatment Network (ATN) is a multisite network of 14 North American academic medical centers that specialize in the diagnosis and treatment of individuals with ASD. The purpose of this multimodal study was to examine how social determinants of health impact access to care across ATN sites.
Objectives: The main goals of the study were to (1) identify underserved individuals in ATN sites' geographically defined catchment areas and determine whether or not they are receiving care at the site (2) identify how each ATN site is meeting the needs of underserved populations, and (3) highlight areas where sites need to increase outreach to individuals.
Methods: The multimodal study included a site-level survey with clinicians and a more detailed catchment area and service area analysis. The 34 items site level survey assessed the local, clinical, and patient characteristics of each of the 14 ATN sites to identify underserved populations and barriers to healthcare delivery. Building on part one, the second part of the study used geospatial mapping software (ArcGIS), to analyze whether sites are serving individuals at risk for not accessing healthcare services within their hospital's defined catchment area. U.S. Census data and Area Deprivation Index (ADI) scores were used to identify zip codes with underserved individuals. After analyzing the data from 12 ATN sites we identified the percentage of high needs individuals within the catchment area and within the service area.
Results: Several barriers to reaching/serving the underserved in ATN communities were identified via the survey. The most frequently cited perceived barriers to reaching/serving the underserved included socio-economic status (42.9%), geographical distance (42%), caregivers' education (35.7) and knowledge (28.5%), as well as transportation limitations (28.5%). Across all ATN sites, the percentage of individuals with an Area Deprivation Index greater than 100 (considered high-needs) in the hospital's defined catchment areas (geographic area where patient population are drawn) was 55.6% and service areas (actual patients who access ATN centers) are 44.5%. The difference between the percentages of high needs individuals in the catchment area and those in the service area ranged from 3.4% to 118.9%. Some sites serve a greater percentage of high needs individuals than those in their catchment area, while other sites are not reaching a large proportion of high-needs individuals.
Conclusions: The survey revealed considerable variability among ATN sites in the demographic characteristics of patients and barriers to accessing care. Geospatial mapping using zip codes is an objective way for autism centers to identify geographical areas where they need to outreach to high needs patients. The catchment and service area analysis revealed areas where ATN sites could focus outreach efforts.

252 **127.252** Predictors of Behavioral Health Treatment Continuation and Adherence in Children with Autism Spectrum Disorders

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Background: Behavioral Health Treatments (BHT) based on the principles of Applied Behavioral Analysis (ABA) can improve many of the core difficulties in autism spectrum disorders (ASD) including social deficits and restricted, repetitive behaviors. While ABA-based treatments are commonly recommended for children with ASD, little is known about how many families continue treatment once they start, nor about characteristics that predict adherence to and continuation of recommended treatment.
Objectives: To identify factors that are associated with continuation of and adherence to BHT in a large, diverse population of insured patients with ASD.
Methods: This cross-sectional study included 226 Kaiser Permanente Northern California members aged 2-18 years old with ASD referred for BHT between February and May 2014. Patients had to receive at least 2 consecutive weeks of billed BHT during the study period to be included. We conducted analyses to explore the associations between socio-demographic factors (child sex, race/ethnicity, age at referral to BHT, type of health insurance, copay amount, maternal age at referral to BHT, maternal and paternal education) and clinical factors (medical complexity, psychiatric medication use, receipt of additional therapies) and the binary outcomes of interest: continuing treatment for at least 12 months and treatment adherence (receipt of >=80% of the authorized treatment hours).
Results: Median age at referral to BHT was 6.0 years (40% < 5 years, 15% 12+ years). The majority of patients were male (83%), and had employer or self-funded insurance (95%), $20 copay or less (78%), mother >30 years of age (91%), and mother (78%) and father (73%) with undergraduate or post-graduate education; race ethnicity was mixed (36% white, 22% Hispanic, 29% Asian, 14% Black/Other). Among patients who initiated BHT, 69% (N=155) continued treatment for at least 12 months. Patients who continued vs those who discontinued BHT were similar with respect to sex, race/ ethnicity, insurance coverage type, medical complexity, and receipt of other treatments including psychiatric medication and rehabilitative services. Patients who continued treatment had a significantly younger median age at referral for BHT (6.0 years vs 7.3 years, p=0.04), were less likely to have psychiatric comorbidities (19% vs 41%, p<0.01) or genetic syndromes (4% vs 16%, p<0.01), had a shorter interval between treatment authorization and treatment initiation (p=0.05), and were more likely to receive >10 hours/ week of BHT (48% vs 14%, P<0.01) than patients who discontinued treatment. Only 15% of patients who initiated treatment adhered to treatment recommendations. Younger age at referral for BHT (p=0.049) and receipt of >10 hours/ week of BHT (76% vs 38%, p<0.01) were significantly associated with adherence to treatment.
Conclusions: Nearly one third of patients discontinued treatment within the first 12 months of starting and only 15% of families were able to adhere to their child's recommended treatment regimen. Our findings suggest that children who are older, who have psychiatric comorbidities or genetic syndromes, who take longer to initiate treatment, or receive less than 10 hours/ week of BHT are most likely to struggle with continuation of and adherence to treatment, and may need additional attention.

253 **127.253** Predictors of School Satisfaction in Parents of Children with Autism Spectrum Disorder

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Background: Â Children with developmental disabilities (DD), including autism spectrum disorder (ASD) and intellectual disability (ID), are entitled to public schooling with appropriate supports (Brown & Percy, 2007). However, little Canadian research has examined parents' satisfaction (or frustration) with the services their children receive in the school system. Research suggests that parents of children with ASD are more likely to report difficulty accessing appropriate services for their child and report more dissatisfaction with their child's care than parents of children with other DD (Vohra et al., 2014). Further, research on individuals with DD, with and without ASD, generally focuses on individuals with milder impairment while children with severe DD are often excluded.
Objectives: Â The present study (1) compared school satisfaction between parents of children with DD, with and without ASD, and parents of typically developing (TD) children; and (2) examined factors that may be predictive of school satisfaction in parents of children with ASD.
Methods: This study is part of the larger GO4KIDDS project (Great Outcomes for Kids Impacted by Severe Developmental Disabilities) looking at the health, well-being, and social inclusion of children with severe DD. Parents of 417 children with severe DD, with and without ASD, and 210 TD children completed online or paper surveys. Groups were similar in age (4 to 20 years) and sex (69% male). Analysis for Question 2 was conducted with a subsample of the ASD group who had completed additional survey questions (n = 107; M_{age} = 10.51; 87% male).
Results: Question 1. Results of an independent t-test revealed that the overall level of school satisfaction (rated on a 5-point scale) in the DD group (N= 398, M= 3.31, SD= 1.19) was significantly lower than that of the TD group (N= 210, M= 3.92, SD= .84), t(558)= 7.34, p<.001, Cohen's d=.59. However, within the DD group, there were no differences in school satisfaction between parents of children with ASD and parents of children with other DD.
Question 2. For the ASD group only, a hierarchical multiple regression was conducted with the mean of a 9-item measure of school satisfaction as the dependent variable. Parent Positive Outlook was entered at Step 1 to control for the potential effect of parent optimism and method variance. Child variables (e.g., adaptive skills and maladaptive behaviour) were entered at Step 2, parent variables (e.g., parent mental health) at Step 3, contextual variables (e.g., SES) at Step 4, and school services (e.g., SLP) and type of school placement (e.g., special education class) at Step 5. The final model accounted for 23.5% of the variance in school satisfaction, with significant coefficients for child's Adaptive Behaviour and Parent Positive Outlook. Further analyses regarding different types of school programs will also be included on the poster, as well as illustrative parent comments.
Conclusions: Results of this study have implications for school-based interventions for children with ASD, particularly those who have limited adaptive skills. These results also point to the need for better communication with, and support for, parents.

254 **127.254** Quality of Life Assessment for Adults with ASD (QLAA)

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Background: Â Service providers working with adults diagnosed with ASD need a reliable standardized QoL instrument to effectively and comprehensively address needs and assist those they serve. In the absence of such a tool, the assessment is often limited with results based on a particular provider's area of specialty. This limitation can lead to an incomplete assessment that includes recommendations for a specific component(s) of one's needs, rather than one than address the full breadth of one's needs. JFCS sought funding from Autism Speaks, and in December 2014 was awarded a $25,000 Family Services Community Grant to fund the development of an appropriate Qol instrument for adults with ASD. JFCS completed the project and developed the Quality of Life Assessment for Adults with ASD (QLAA) in December 2015.
Objectives: Â In order to assess an individual's quality of life, the following components must be assessed: physical well-being, psychological well-being, social well-being, independence, education, and employment. By measuring overall quality of life, as well as scoring each of these domains, direct care workers may identify the individual's needs, and develop individualized and meaningful treatment plans.Â The QLAA includes the six mentioned domains of quality of life, and the values, goals, aspirations and current life circumstances of the adult completing the QLAA. The QLAA may be used by social service providers working with adults diagnosed with ASD.Â These professionals may utilize the QLAA in the following ways:

- To determine client needs during the initial assessment
- When reviewing needs and progress
- To inform strategy to match unmet needs to available services
- To evaluate service appropriateness
- To evaluate the effectiveness of interventions

Methods: A literature review on QoL and existing measurements was completed. A multidisciplinary focus group was hosted with professionals working with adults with ASD. Interviews were conducted with adults diagnosed with ASD as well. The adults were asked to define QoL, list and describe the factors that impact QoL, and provide suggestions and recommendations about the implementation of a QoL instrument. Transcriptions of the interviews and focus group were reviewed as well as existing QoL tools, and re-occurring concepts were identified to generate the primary items included in the QLAA.Â The QLAA was piloted with 23 participants. 11 participants completed the QLAA a second time, and 8 participants identified 2 individuals who knew the participant well to complete the QLAA by proxy.
Results: Participants' Overall Score: Employed Avg= 148 (Range: 45-180); Unemployed Avg= 129 (Range: 45-168).Â Common responses to "what is important to you?": Social support, employment, hobbies, health, community engagement and independence.
Conclusions: Â (1)Â 3 items were revised based on participants' feedback; (2) When comparing the proxy scores to the participants' scores, results indicated that individuals who know the adult well may be a reliable source in determining his/her qol, which is useful if the tool cannot be administered directly with the adult due to communication impairments; (3) Due to the small sample size of this study, the QLAA must be used with a large sample to further assess its validity.

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255 **127.255** Racial Disparity in Mental Healthcare Services Access and Utilization Among Children with ASD in the US

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Background: Researchers indicate that mental healthcare disparities are apparent among minority children with Autism Spectrum Disorder (ASD) (Mandell, et al., 2009). Disparities in the access and use of health and mental health care services are particularly alarming in the context of children and adolescents with ASD. Poor access to and underuse of health and mental healthcare services, especially among youth, can result in an exacerbation of the current condition as well as the onset of additional and related conditions, which end up being more costly and harmful from a public health standpoint (Parish et al., 2011). Minority children with ASD are at particularly high risk of not receiving adequate and appropriate mental healthcare services. However, this issue has received scant attention as evidenced by the very limited number of research studies about it.
Objectives:
The purpose of this study is to examine the mental healthcare disparities in terms of racial and/or ethnic differences between minority children with ASD and White children with ASD.Â Specifically, we aim to investigate the types and levels of services minorities children with ASD are using and examine the risk and protective factors that exist for children with ASD from ethnic and racial minority families, which affect accessing and utilizing health care and education services.
Methods:
Using data from the 2011 Survey of Pathway to Diagnosis and Services ("Path Way") (N=1725; White= 1368, Minority=347), we conducted bivariate and multivariate logistic regression to examine the differences between minority and White children with ASD in accessing and utilizing mental healthcare services. "Pathway" is a nationally representative survey about children, 6-17 years, who were identified by the 2009/10 National Survey of Children with Special Health Care Needs (NS-CSHCN). The data set takes a close look at the current and past use of clinical treatments, interventions, and healthcare services.
Results:
We found minority children with ASD received less behavioral intervention or modification services and less cognitive–based therapy compared to their White counterparts. However, differences related to specific services such as sensory-integration therapy, occupational therapy, physical therapy, social skills training, other social skills training, and speech and language therapy in school and other settings were found to be insignificant. Additionally, the data analysis yielded some significant differences between White and minority children with ASD in regard to working with healthcare providers. Minority families tended to work with audiologists and developmental pediatricians more often than Whites and minorities tended to work with neurologists and psychiatrists less frequently compared to their White counter parts.
Conclusions:
The results of this study indicate that the type and quality services that children with ASD from minority populations receive need improvement. In addition to the need for assertive policy to support the availability of behavioral and cognitive-based therapy, future research needs to explore effective disparity-reduction strategies that promote both the amount and quality of services children with ASD from minority households receive.

256 **127.256** Racial and Ethnic Differences in the Utilization of Emergency Departments for Transition Age Young Adults with ASD Only and ASD with ID

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Background:
Racial and ethnic differences in emergency department (ED) utilization are well known in the literature for typical young adults. Less is known about differences among those with autism (ASD) with or without intellectual disability (ID). In particular, little is known about ASD and ID young adults covered by Medicare. Persons less than 65 covered by Medicare have met criteria for a disability designation by the Social Security Administration. This may indicate a greater severity of disability. Furthermore, adults with ASD/ID often encounter difficulty finding appropriate providers and are more likely to have injuries and comorbidities that necessitate visits to the ED.
Objectives: This presentation will describe racial/ethnic differences in ED utilization among young adult Medicare beneficiaries aged 18-25 years with ASD and no intellectual disability (ASD-only) as compared to beneficiaries with ASD and ID (ASD+ID).
Methods:
We conducted a retrospective analysis of existing national Centers for Medicare and Medicaid (CMS) claims Limited Data Sets (LDS) for 2008-2010. ASD and ID cases were identified by searching all claims types (Inpatient "IP", Outpatient "OUT", Hospice, Carrier, Skilled Nursing and Home Health) for ASD beneficiaries (ICD-9 diagnosis codes 299.xx) and diagnosis codes 317.xx, 318.xx or 319.xx as ID. Claims associated with ED utilization for treat and release (T&R) ED events were identified in the Outpatient File using Revenue Center Codes "0450", "0451", "0452", "0456", and "0459" and the Patient Discharge Status Code. ED events admitted to the same hospital were identified using the Admit Source Code in the IP file.Â This study combined the two types of ED visits for analysis. Zero inflated negative binomial (ZINB) regression models were conducted separately for 2008, 2009 & 2010 and included binary indicators for ASD+ID versus ASD-only, sex, age group (23-25 vs. 18-22), ACG Concurrent Risk Score and Medicaid buy-in months. Minority status was identified as any Hispanic or racial minorities not listed as white: black, Asian, north American native, & Hispanic. The relationship between group status and minority status for ED visits is examined with an interaction term in the ZINB model.
Results:
Only results for 2008 are presented here due to space limitations. All 3 years will be presented at the conference. The ASD-only group was composed of 25.6% racial/ethnic minorities and the ASD+ID group was 33.9% minority.
Table 1 Demographic characteristics.
Table 2 displays the ZINB model for number of ED visits during 2008. The ASD+ID group had 17% more ED encounters. Minorities as a group appear to use 28% fewer ED visits. Examining Minority Status by ASD+ID and ASD-only separately reveals that the ASD+ID-Minority subjects used 30% more ED visits per year than the ASD-only-white group.
Conclusions:
Minorities appear to use fewer ED service when examined as a group. ASD+ID-Minorities use 30% more ED services as compared with ASD-only-white subjects. Additional research is needed to determine whether choice is the primary driver of ED utilization in this population or whether other factors like case severity, comorbidities and provider availability are driving the increased ED utilization.

257 **127.257** Reducing Behavioral Crisis Emergency Room Visits through a Novel Care Model: Behavioral & Developmental Neuropsychiatry (BDNP) Care Continuum

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Background: The Behavioral & Developmental Neuropsychiatry (BDNP) care continuum group at Cincinnati Children's Hospital in the Division of Psychiatry frequently serves patients with ASD and significant irritability marked by physical aggression, self-injury, and severe tantrums. High patient acuity and limited outpatient care resources contribute to high emergency room (ER) visit rates when in crisis in this population. The BDNP care continuum has 3 mechanisms to reduce ER visits for behavioral crises in the highest acuity patients: 1) Outpatient nurse care management; 2) Mental Health Specialist support in outpatient clinic to enhance outpatient visit safety thus promoting adherence to outpatient care; 3) An across the continuum effort to direct admit patients (bypassing an ER visit) to our BDNP inpatient unit when admission is deemed necessary.
Objectives: The key objective of this study was to assess the rates of ER visits for behavior pre- and post-enhanced continuum care efforts in the first 30 patients served in our ASD/MI care continuum. The *specific aim* was to determine if enhanced outpatient management was associated with reduced ER visit rates. The *key secondary aim*was to determine any potential cost savings associated with findings from our primary aim.
Methods: We gathered data from the first 30 patients with ASD/MI enrolled in our enhanced BDNP care continuum.Â Requirement for enrollment in this enhanced level of care included a history of severe self-injury and/or aggression and a clinical global impressions severity (CGI-S) score of 5 "very ill" or greater. This data review project was approved by the CCHMC IRB. Data was extracted from EPIC charting looking at ER visits for behavioral reasons for each of the first 30 patients enrolled in the enhanced BDNP care continuum. Our primary outcome is a comparison of the number of ER visits for behavioral reasons on an annualized basis prior to and after the implementation of enhanced BDNP care for each patient assessed.
Results: Each patient showed a reduction in ER visits per year due to behavioral crisis. All patients met diagnostic criteria for intellectual disability, autism spectrum disorder, and intermittent explosive disorder. A statistically significant mean reduction in annualized ER visits for behavioral crisis was noted (See Figure 1; change from a mean 1.7 +/- 0.9 ER visits per year pre-intervention versus 0.3 +/- 0.4 visits per year post-intervention; $p<0.0001$). For this patient cohort followed, an estimate ER visit cost savings of $92,405 per year was calculated.
Conclusions: This report is consistent with reduced ER visits for behavioral concerns post enhanced BDNP care initiation. Future Directions include, but are not limited to, the following: 1) Assess for potential patient and family quality of life change with initiation of this treatment approach; 2) Assess for injury reduction associated with enhanced care initiation; 3) Assess the ability to expand and develop the model to meet a growing need for such services. We hope to expand this work to a broader group of patients in the future in need of these services.

258 **127.258** Right Kids, Right Time, Right Services: Translating Research to Practice in Early Detection of Developmental Challenges in Early Childhood Education Settings

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Background: Valid and reliable tools have recently been developed to accurately detect early signs of autism spectrum disorder (ASD) and other developmental challenges in children as young as 12 months of age. Translation of research findings to practice and policy through routine implementation of evidenced-based tools in the community, particularly early childhood education and care childcare settings is limited and a two year delay for young children with early signs of ASD in accessing diagnostic assessment and early intervention persists in many communities.
Objectives: The study aimed to compare the effectiveness of current practice of developmental surveillance (PEDS; broadband open questions completed by parents) with the Social Attention and Communication Surveillance system (SACS-R; targeted checklist of key markers for ASD and developmental delay at multiple age points completed by educators or nurses) in both health and early childhood education settings in the early detection of ASD.
Methods: A comparison of results of developmental surveillance using PEDS and SACS-R was conducted in two separate prospective, longitudinal cohort studies to establish reliability and validity of developmental surveillance procedures across health and education settings, urban and regional locations and sample across a range of demographic conditions.
Results: This study established that the interrater reliability of early childhood educators in administering the SACS-R is similar to nurses and is very high (k = 0.909). Reliance on parent report alone via PEDS, as is current practice in many communities, has the potential to miss nearly half of children (48.2%) undergoing developmental monitoring. Sensitivity, specificity, positve and negative predictive values of SACS and PEDS are reported based on comprehensive developmental assessment and Autism Diagnostic Observation Schedule- 2nd edition (ADOS-2) for children referred from the health or early childhood education system (n=305).
Conclusions: Â Highly likely cases of ASD or significant developmental challenges in this study would have gone undetected if SACS-R was not used during a child's visit to a health check or in their childcare setting. Results support the implementation of the SACS-R across health and education settings as a reliable and valid method of early detection of children with ASD and informs policy and practice in the childcare sector which presents an ideal opportunity for ongoing developmental surveillance and appropriate, timely referral of young children to essential early intervention supports.

259 **127.259** Role of Care Coordination in Improving Access to Services for Newly Diagnosed Children

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Background:
Difficulty accessing appropriate services and supports are major concerns of families and stakeholders in the post-diagnosis period. While early diagnosis of autism is essential, it is also imperative that young children begin receiving appropriate intervention and services following diagnosis without delay. In order to address challenges faced by families during this period and ensure smooth transition to necessary supports an innovative model of care coordination services was introduced. In recent years care coordination services have in received increased recognition as an important tool in achieving optimal health and wellness outcomes for vulnerable populations (APA Policy statement 2014) and as a key service for children with ASD (Doehring 2013).
Objectives:
The present study examines the utility of care coordination strategies to support families as they learn to navigate complex systems. More specifically, we looked at how our model of care coordination service provision provided immediately post-diagnosis impacted families in our clinic.
Methods: Â The study took place in a large autism specialty center that serves an ethnically diverse and often economically disadvantaged population. In 2013, as part of a larger effort to improve the quality of clinic services, we began offering care coordination to all families on the day of diagnosis. Working collaboratively with the diagnostic team, the care coordination team developed comprehensive personalized packets of ASD resources and provider information unique to each child and family's needs based on the team's clinical recommendations. In addition to the take-home packet, each family met with a care coordinator who is then available to assist the family on an on-going basis. Beginning in 2016, satisfaction surveys were sent to all families receiving care coordination services post-diagnosis (n=462) with a response rate of 12% (n=55).
Results:
Survey responses indicated a high degree of satisfaction with services provided (94%). At the same time, 94.4% expressed satisfaction with meeting the care coordinator on the day of diagnosis. In describing what aspects of the program were most helpful, families ranked in order: (1)"receiving autism-related information resources"; (2)"time to ask questions"; (3)"information on community providers"; and (4)"emotional support"; however, the majority of families indicated "all of the above" as most helpful. In response to whether resources provided helped families connect with services, 76% responded in the affirmative. In addition, nearly all (98%) indicated intention for future contact with their care coordinator.
Conclusions:
Survey results were overwhelmingly positive and confirmed our thinking that meeting with a care coordinator immediately post-diagnosis was beneficial. A repeated comment from families was that they appreciated receiving a resource packet and having someone to explain the information to them. While families rated individual aspects of the materials and services provided positively, the majority of respondents expressed most satisfaction with the combination of all four aspects of the program. The high level of satisfaction, in combination with the majority of respondents stating intent to continue contact with their care coordinator suggests the model may be a valuable addition to clinical service array.

260 **127.260** Services and Care for Adults with Autism Spectrum Disorder in the European Union: A Multi-Site Assessment By the Asdeu Consortium

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Background: In the wake of dramatic increases in autism spectrum disorder (ASD) diagnosed in children we now see an unprecedented increase in persons with ASD entering adolescence and young adulthood. In comparison with research in children, however, the research base focusing on ASD in adulthood is underdeveloped. There is relatively little research knowledge regarding autistic adult services and care or the readiness of communities to provide adult services for persons with ASD.
Objectives: Create a framework for improving services and care for autistic adults in the European Union (EU) through improved understanding of current care practices, gaps in care provision, opportunities for care improvement and local models of adult care as part of the Autism Spectrum Disorder in the European Union (ASDEU) consortium comprised of 20 partners in 14 EU states.
Methods: The 5 adult services focus areas are approaches to services and treatment, management of comorbidity, access to diagnosis and post-diagnostic support, transitions during adult life, and autistic elder care. Study methods include 1) site-specific literature and key informant searches regarding local organization of services and local services policies and recommendations for autistic adults in each participating country; 2) on-line surveys of knowledge, experiences and opinions of experts, adult service providers, autistic adults, and carers of autistic adults regarding local current care practices, perceived service gaps, examples of local best practices, and suggestions for improving existing care strategies. Survey questions were derived from 'external referents of care', i.e., published adult services and care recommendations, and survey answer choices were designed to gauge how closely the respondent believes the local situation 'fits' the recommendations.
Results: Local literature and informant searches yielded complex views of variation in services organization across EU states at the national, regional, and municipal levels for the public and private sectors. The number and geographic distribution of autism-specific organizations providing services is highly diverse across countries, but with geographic clustering in major urban areas and capital cities. There is considerable variation in the public-private sector balance in services provision both between AND within countries. The private sector appears to be the core knowledge and competence base in adult services and in many countries is the main provider of autism-specific adult services. Even within countries, however, there may be significant inequalities in the public and private coverage among different regions and the level of development and specialization of the services offered by private organizations may be limited. The study is ongoing, with results from the on-line surveys to come.
Conclusions: Even in its preliminary stages, the investigation thus far has yielded an overarching view on the state of services for autistic adults and elders in the EU, a state which appears to rest on the balance between public and private sector contributions. Preliminary results from the on-line survey to be presented will illustrate the concordance between published autistic adult services recommendations and real-world experiences across the EU. Final study results will support EU policy makers and service providers on strategies for autistic adult services.

261 **127.261** Supporting Educational Personnel to Train Their Staff in ASD: A Pilot Study

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Background:
Teachers, paraprofessionals and related service personnel who work in special education rarely receive specialized training in autism. This pilot study evaluated a new Training Academy to support existing school personnel to train their own staff. Participants attended the Training Academy as a supportive, collaborative cohort. The cohort received training materials and in-vivo practice sessions, prior to delivery of each training. Participants were required to provide their own school staff with 3 trainings: ASD for a general audience; ASD specific to paraprofessionals; ASD specific to speech, social work and O.T.
Objectives: This study investigated the effectiveness of the Academy model to increase education professionals competence in delivering training to their staff. The study addressed:
(i) educator change in competence of training skills gained across the training period
(ii) the relationship of educators self-efficacy to outcome
(iii) the relationship of educator self-efficacy to professional experience prior to training
Methods:
Participating educators (n= 15) who attended the Academy completed a structured questionnaire pre and post training.
The questionnaire emphasized key aspects of training competencies. Three sections described a training scenario related to (i) general ASD knowledge, (ii) paraprofessional competencies (iii) related services competencies. The final questionnaire had 12 questions; maximum score, 72.
In addition, the participants completed the ASSET, a self-report measure to assess self efficacy in ASD specific skills (Ruble et al.,2013).
Results:
i) T-test revealed that there was a significant ($p<.01$) increase in competence scores pre and post training academy for each type of training provided (general ASD, paraprofessional, related services).
ii) ASSET scores were divided by the mean to create high and low self efficacy groups. To compare group performance pre and post training, scores were entered into a repeated measures multivariate analysis of variance, with time (pre, post) as the within subjects repeated measure and group (high, low SE) as the between factor. There was no significant group by time interaction effects.
iii) To determine the effect of prior experience on educator self-efficacy, data was entered in a logistic regression model with group membership (high and low self-efficacy) as the dependent variable, and lifetime number of ASD students, educational level, and years teaching as covariates. There were no significant effects of professional experience predicting self-efficacy group membership.
Conclusions:
These results indicate the effectiveness of our training program. By attending the training, educators increased their confidence in their ability to train the autism curriculum to their staff. Educators in both the low and high self-efficacy groups increased their training competence scores over the training period. Furthermore, educators' self-efficacy for training competencies appeared to have little relationship to their prior professional experience, experience with autism or their educational level. This has important implications for training educational professionals. Even professionals who have many years experience, or who have taught many students with ASD, can increase their own training competence by attending an intensive training. The sample size is small and results must be interpreted with caution. The Training Academy is now being provided to professionals in a second cohort.

262 **127.262** The Complex Road to ASD Interventions: Parents' and Providers' Views of Barriers and Facilitators

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Background: As a result of autism insurance mandates, health plans in many States are required to cover the cost of ASD behavioral health treatments (BHT). While there is a growing body of research evaluating the effectiveness of BHT, little is known about what helps or hinders participation in recommended BHT services.
Objectives: To identify factors that influence parent participation in and compliance with recommended BHT services for their child with ASD.
Methods: We conducted interviews (N=84) with parents and clinical providers of children with ASD referred for BHT by Kaiser Permanente. We used a non-probabilistic purposive sampling approach to capture the range of race/ethnic groups among patients (13 white, 10 Asian, 6 Hispanic, 3 African-American, 8 Other) and their experiences with BHT treatment (child never started (N=10), child started but discontinued (N=8), child currently receiving (N=22). The provider group included KP clinicians (16 pediatricians and psychologists, 11 case managers) and non-KP BHT providers (17 ABA interventionists and supervisors). Three interviewers trained in qualitative methods developed guides and conducted all interviews. Areas explored with parents included acceptability of care, attitudes and beliefs about autism, language and literacy, involvement in care, education/income, stigma, family functioning, and specific experiences with the treatment process. Questions to providers about their experiences with the services and with their patients completed the picture. Interviews, in person or by telephone, ranged from 30 minutes to 2 hours.
Results: Many parents expressed confusion and difficulty navigating a complex system to access BHT. Obstacles to initiating or continuing BHT included financial burden, gaps in care coordination, deficient quality of care, and other effects of treatment such as the financial impact of the number of hours recommended, and the invasion of privacy resulting from in-home therapy. Immigrant families encountered additional obstacles including language, cultural, and literacy barriers, and lack of culturally competent support. Many KP providers echoed the parents' frustration with the system, which they perceived as overloaded, unwieldy, lacking high quality interventionists, and too restrictive for case managers. From the point of view of BHT providers, barriers to families initiating and continuing BHT services include lack of capacity of BHT providers to keep up with the number of referred children, family difficulties with choosing or committing to a vendor, vendor difficulties establishing contact and scheduling visits with families, turnover in intervention teams, and the practice of assembling teams for each child, rather than having permanent, full time staff onboard. There is a shared perception among some parents and providers that business interests trump the care of individuals. Possible solutions suggested by parents, KP clinicians and BHT providers included improved education and training for parents and providers, active case management, improved care coordination, availability of translated materials, interpreters trained in ASD, culturally competent providers, and introduction of patient navigators.
Conclusions: The interviews provided insights about the experiences of an ethnically diverse group of ASD families referred to BHT services. Many barriers were experienced by both families and providers. Overcoming them is necessary in order to reap the benefits of BHT.

263 **127.263** The Conditions and Characteristics of Adult Supplemental Security Income Recipients with Autism

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Background: Â Achieving economic security and independence is an everyday challenge for many adults with Autism Spectrum Disorder (ASD), who often have high rates of unemployment, earn low wages, and have high medical costs. Several studies of young adults with ASD have found low household income to be inversely related to several key outcomes including employment, independent living, and access to services. The federally-administered Supplemental Security Income (SSI) program provides income support to alleviate some of the adverse effects of poverty for people with disabilities. In 2014 alone, 8.3 million people received SSI benefits in the United States at an annual cost of $55 billion. Despite its pivotal importance, however, virtually nothing is known about the population of adult SSI recipients with autism.
Objectives: Â We used a mix of Social Security Administration (SSA) program data and SSA's National Beneficiary Survey to generate national point-estimates of the conditions and characteristics of adult SSI recipients with autism.
Methods: Â We described the characteristics, employment status and benefits of adults with a primary or secondary impairment of ASD who received SSI in December, 2014. To report aggregate data of SSI receipt over a 14-year period, we examined the population of adults with ASD who received at least one SSI payment during *any month* in FFY 2001 through 2014.
Results: Â Roughly 129,500 adults with ASD received SSI for at least one month in 2014, a 740% increase since 2001. Among them, nearly 37,050 people also had intellectual disability (ID) as a listed impairment. Roughly 85,330 adults with ASD and no reported ID received SSI in December 2014. Seventy-three percent of these recipients were between the ages of 18 and 25 years, and 81% were male. Around 79% were living in their own household or alone and 19% lived in someone else's household receiving support and maintenance. Sixteen percent were employed in December 2014 with an average earned income of $194/month. The 2014 annual SSI payment amount varied: roughly 46% received the maximum annual SSI payment amount of $8,652, 39% received between $4,326 and $8,651, and 15% received less than $4,325.
Conclusions: This study is an important first step in building an accurate description of the population of SSI recipients with autism. Further research is needed to improve our understanding of how adults with autism access and maintain SSI benefits, how service needs change across the life span, and how SSI benefits relate to later health and economic well-being.

264 **127.264** The Costs and Benefits of Employing an Adult on the Autism Spectrum

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Background: Comparatively few adults on autism spectrum participate in the competitive workforce. In Australia, the labour force participation rate for adults on the autism spectrum is 42% in comparison to 53% of all individuals with disabilities, and 83% for individuals without disabilities. While once employed adults on the autism spectrum have the opportunity to demonstrate their strengths, low employment rates suggest many factors are influencing their employability. One factor may include employers' assumptions that hiring individuals with a disability will incur higher costs due to additional work training, supervision and modifications. Research has examined the benefits and costs of employing adults on the autism spectrum from the perspective of the employee, taxpayer and society, but few studies have considered the employer perspective.
Objectives: This study examined the costs and benefits of employing adults on the autism spectrum, from the perspective of employers.
Methods: An online survey of 59 employers employing adults on the autism spectrum in open employment was conducted. Employers were asked to compare employees *with* and *without* autism on the basis of job similarity.
Results: Compared with employees *without* autism, employees on the autism spectrum demonstrated increased attention to detail (55% vs 19%), a higher work ethic (71% vs 30%) and consistently produced work of superior quality (41% vs 26%). Challenges associated with employing adults on the autism spectrum included following instructions (14% vs 4%), being flexible (28% vs 8%) and perseverating on work tasks (16% vs 8%). While the mean hourly wage for employees on the autism spectrum was lower ($21.84/hour), compared to their co-workers' wage ($23.49/hour), this study found no significant differences between employees *with* and *without* autism with regard to weekly supervision costs, weekly costs to the employers and costs related to workplace training and modifications. Additional benefits of employing an adult on the autism spectrum included increased autism awareness in 59% of workplaces, and in 55% of workplaces promoting a culture of inclusion. More than 60% of employers reported that they would recommend employing an adult on the autism spectrum to a business associate, with very few responding that they would not.
Conclusions: Employing an adult on the autism spectrum provided many benefits to employers and their organisations without incurring additional costs over and above that associated with any new employee. The results also showed that employing adults on the autism spectrum contributed to new and innovative ideas and can have a positive impact on workplace culture and attitudes, but highlighted the need for support for employers through autism awareness and education in the workplace.

265 **127.265** The Effect of Familial Status on the Attainment and Funding of Services in Children with ASD

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Background: Single parents of children with autism spectrum disorder (ASD) report elevated levels of stress related to child care and work responsibilities (Johnson & Simpson, 2013). Additionally, parents face high costs for ASD-related intervention services (Tregnago & Cheak-Samora, 2006). As such, un-partnered parents may have more difficulty obtaining intervention services for their child due to high stress and financial burden. Moreover, familial status may affect funding options or services utilized.
Objectives: Â The goal of the current study was to examine how marital status relates to access to intervention services and public vs. private funding for services in families with a child with ASD.
Methods: Â Participants included families of 116 children diagnosed with ASD after screening positive on the Modified Checklist for Autism in Toddlers (-Revised), with Follow-UpÂ (M-CHAT(-R)/F) during 18- and 24-month visits at pediatricians' offices in metro-Atlanta. Families also attended a re-evaluation between 3-4 years of age *(M_{age}*=48.47 months*, SD*=12.32*)*, and provided information about intervention participation and funding of each service received since diagnosis (state/school funded vs. any use of private insurance/pay). Interventions included: speech-language, occupational, physical, developmental, sensory-integration, and behavioral therapies, as well as special education, special (pre)schools, and Babies Can't Wait early intervention program. Complementary therapies that did not fit these categories were coded into a separate "Other" category. The number of services, type of services, and source of funding for each intervention were examined in relation to family structure (partnered vs. non-partnered).
Results: Overall, 90.2% of children with partnered parents and 87.0% of children with non-partnered parents got some type of intervention service, which was not a significant difference, X^2(1, *N*=115)=.209, *p*=.45. However, children with partnered parents (*M*=3.09, *SD*=1.77) received more types of services than children with non-partnered parents (*M*=2.30, *SD*=1.49, *t(*113)=1.98, *p*=.034). In particular, children with partnered parents (31.5%) are more likely to use complementary interventions (i.e., "Other") than children with non-partnered parents (4.3%, X^2(1, *N*=115)=7.05, *p*=.005). No significant difference across any other intervention type was found. There also was no significant difference between familial status and use of public funding for services for most types of interventions, with the exception of pre-school; more non-partnered parents (86.7%) paid for pre-school with public funding than partnered parents (53.7%, X^2(1, *N*=82)=5.53, *p*=.021).
Conclusions: Â The majority of families received at least one type of intervention service regardless of marital status, suggesting that single-parent households are not at a large disadvantage. However, one-parent households received fewer *types* of interventions compared to two-parent households. Specifically, children with partnered parents received more nonconventional therapies (i.e. "Other"), such as music therapy and hippotherapy, which is consistent with Hall's (2012) finding that partnered parents are more likely to utilize complementary/alternative therapies. This suggests single parents may lack resources to enroll their children in alternative services. Future research on the efficacy of specific types and number of interventions is needed to further understand whether children with partnered parents are making greater gains due to increased access to more types of intervention services.

266 **127.266** Therapist Adaptations to a Package of Evidence-Based Strategies for Children with Autism Spectrum Disorder

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Background: There is growing evidence that it is common for therapists to adapt evidence-based practices (EBP) protocols when implementing in routine mental health (MH) settings. Less is known, however, about the types, rationale, and implications of these adaptations on clinical and implementation outcomes (Wiltsey-Stirman, et al. 2015).
Objectives: This mixed-methods study examined the types and reasons therapists adapted AIM HI ("An Individualized Mental Health Intervention for ASD"), a package of evidence-based strategies designed for children with autism spectrum disorder served in publically-funded MH settings.
Methods: Quantitative (Therapist Adaptations to Practice Questionnaire (TAPQ)) and qualitative data (semi-structured interviews) were collected as part of a randomized effectiveness trial of AIM HI in which MH programs were randomized to immediate AIM HI training/implementation or wait-list control/routine care observation condition. TAPQ and semi-structured interviews were completed with a subgroup of therapists (n=51) from 14 MH programs following 6 months of AIM HI training/consultation. Emergent themes from qualitative data were used to complement and expand findings from the TAPQ characterizing the types of adaptations therapists report. .
Results: On the TAPQ, 95% of therapists reported that they made some adaptations to AIM HI, and the most common *types* of adaptations included: (1) integrating components of other treatments in the delivery of AIM HI (35% of therapists); (2) lengthening the pacing of an AIM HI protocol step (33%); (3) modifying the terminology or language/wording when describing AIM HI concepts/components (30%); and (4) involving other individuals (e.g., teachers) in the treatment process (26%). Less common adaptations included: (1) shortening the pacing of protocol steps (11%); (2) adjusting the order of the protocol steps (4%); (3) skipping protocol components (3%). The following were the most common *reasons* for adaptations: (1) *intervention-client fit*, including accommodating the child (48%) and caregivers' (48%) clinical functioning or needs and increasing caregiver involvement in treatment (49%); and (2) *intervention-provider fit*, including consistency with the therapists' previous clinical practice/style (28%). Preliminary themes from the qualitative interviews confirmed and expanded upon the most common adaptations and reasons for these adaptations. For example, therapists indicated that they often modified the AIM HI terminology to make concepts easier to understand for a range of caregiver characteristics (e.g., monolingual Spanish-speaking caregivers, those with lower education or literacy levels, and those with their own mental health/developmental challenges).
Conclusions: Results suggest that most therapists made adaptations to the AIM HI protocol. It is encouraging that adaptations were consistent with the AIM HI protocol, with the primary intent of enhancing the intervention to fit with therapeutic style and to address clients'/caregivers' needs and functioning. These findings suggest that therapists are able to implement fidelity-consistent adaptations to the AIM HI protocol and provide insight into potential areas in which therapists would benefit from targeted training on how to systematically adapt the AIM HI protocol.

267 **127.267** Understanding General Practitioners' Knowledge, Attitudes and Experiences in the Recognition and Management of Individuals on the Autism Spectrum

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Background:
In many countries, the general practitioner (GP) or primary care physician plays a key role in the identification and management of children, young people and adults on the autism spectrum. In the United Kingdom (UK), they are often the first port of call for those seeking assistance for a suspected autism diagnosis. However, changing definitions of autism, the substantial heterogeneity both between and within individuals, and the prevalence of co-occurring conditions in many autistic children and adults all present serious difficulties to non-specialist clinicians. Indeed parents of autistic children, and autistic individuals themselves, often report dissatisfaction with their healthcare experiences, especially regarding the diagnostic process.
Objectives:
In the UK, there have been recent calls for increased autism training for GPs and other frontline professionals, yet there is a paucity of research on what GPs currently know about autism and how confident they feel in making clinical decisions for their patients. We therefore conducted the first study to our knowledge to determine GPs' level of existing autism knowledge and experience, and their perceived confidence in working with autistic patients.
Methods:
An online survey was sent to registered GPs based in the UK. The survey collected responses on participants' (1) background, training and experience as a GP, (2) a 22-item knowledge of autism questionnaire and (3) a 14-item self-efficacy scale targeting GPs' confidence in their abilities around the diagnosis and management of autism, and (4) an open question eliciting participants' experiences on working with autism.
Results:
304 participants completed all three parts of the survey, with 91% indicating that in the past year they had been approached by at least 1 patient about a suspected autism diagnosis, with the majority (78%) being approached by up to 5 people. GPs generally scored highly on the knowledge of autism scale (mean=19.4 out of 22) – despite 40% reporting never having received formal training about autism. Nevertheless, participants reported remarkably limited confidence in their abilities to identify and manage their autistic patients, with many citing a number of barriers including unclear referral pathways and limited local support services. Perceived self-efficacy was also significantly associated with personal experience of autism and the amount of autism training received.
Conclusions:
GPs' confidence may well play a role in their decisions to refer – or not to refer – children or adults for further diagnostic assessment for autism. Efforts to enhance perceived self-efficacy are therefore much needed. Our findings suggest that initiatives targeted towards training on autism and greater clarity around referral pathways for diagnosis of autism should be key priorities in order to improve both GPs' confidence in caring for their autistic patients and autistic people's experiences with GPs. In England, local clinical commissioning groups (CCGs) are best served to assist GPs in ensuring that they can reliably detect the condition and make appropriate provisions for support.

268 **127.268** Use and Perceived Evidence-Base of Autism Spectrum Disorder Interventions By Allied Health Practitioners

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Background: Recent reviews of the research have identified empirically-supported interventions for people with Autism Spectrum Disorders (ASD) (e.g., National Autism Centre, 2015; Wong et al., 2015). However, a research to practice gap is widely acknowledged (e.g., Cook, Cook, & Landrum, 2013) with continued use of interventions classified as unsupported (e.g., sensory integration), ineffective (e.g., facilitated communication), and/or harmful (e.g., chelation) reported by parents (e.g., Carlon, Stephenson, & Carter, 2014) and professionals (e.g., Kadar et al., 2012). Little is known about why specific practices are used by allied health professionals in the community, including their knowledge of the evidence base for their chosen practices, and what factors hinder or facilitate the use of empirically-supported treatments. This information is vital for bridging the research to practice gap and improving ASD intervention outcomes.
Objectives: We aimed to explore reported levels of use of intervention strategies and their perceived evidence-base, and the impact of organisational culture, attitudes, and demographic variables on use of ASD interventions.
Methods: Â Participants included 140 allied health staff (speech pathologists, occupational therapists, psychologists, and behaviour analysts) from across Australia who reported working with people with ASD. They completed an online survey that included measures of demographics, the Organisational Culture Questionnaire (Russell et al., 2010); the Evidence-based Attitudes Scales (Aarons, 2004), and the Intervention Practices Scale (Paynter & Keen, 2015). In addition, participants were asked to rate the level of empirical support for each practice.
Results: Â Participants reported greater use of empirically-supported than emerging or unsupported practices. Participants' use of empirically-supported, emerging, and unsupported practices was linked to the level of evidence of each category perceived by participants. This included greater use of unsupported practices by those rating them as having a stronger evidence base. Although participants generally rated unsupported practices correctly and more rarely used these practices, a significant minority reported continued use of unsupported and potentially harmful practices such as facilitated communication and reported beliefs that such practices were empirically-supported. Those who reported using more unsupported practices also reported greater openness to using a range of strategies and trended toward being more likely to use strategies if they personally appealed to them on the evidence-based attitudes scale. Greater use of empirically supported interventions showed a trend towards lower negative attitudes towards evidence-based practice. No significant links to organisational culture were found.
Conclusions: This study adds to our understanding of the intervention practices used with people with ASD by allied health professionals. It also highlights the continued challenge of translating research to practice in ASD, in particular in terms of debunking misinformation about the effectiveness of strategies shown in research to be ineffective, an area that has to date received little attention. Future research using direct observation could extend this research through investigating the fidelity of implementation of practices and consistency with self-report. Such research would provide valuable insight into the strengths and needs of practitioners and would assist in developing strategies to support knowledge translation to allied health practitioners in the community.

269 **127.269** Using Technology to Support Early Intervention Providers to Build Capacity in Families of Toddlers at Risk for Autism Spectrum Disorder

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Background:
Caregivers are the most community-viable agents of change in providing necessary supports and services for very young children (12-24 months) at risk for ASD. Yet, research shows that the early intervention system is ill-prepared in the specific skills and methods needed to effectively collaborate with and coach caregivers (Friedman & Woods, 2012). In addition, personnel shortages in the early intervention system (Cason, Behl, & Ringwalt, 2012) have resulted in reduced quality and duration of services for families, particularly those living in rural areas (Hallam et al., 2009). Therefore, more innovative methods for providing support and coaching to Early Intervention Providers (EIPs) is necessary to ensure development of knowledge and skills and translation into practice (Bransford et al., 2000). However, there is a paucity of research on the effectiveness of coach-the-coach models supporting EIPs with the use of technology.
Objectives:
This ongoing project aims to improve collaborative coaching proficiencies of EIPs across Georgia via implementation of a coach-the-coach model focused on increasing knowledge of adult-learning strategies, early red flags for ASD, and supports to build family capacity to promote active engagement for toddlers at risk for ASD. The project utilizes innovative, mobile coaching technology to create a community-viable system for reaching families.
Methods:
This study is tracking the progress of 19 EIPs across Georgia, including underserved rural areas, coached to coach caregivers on increasing active engagement in toddlers at risk for ASD. Each EIP is coached over the course of a year, with most coaching sessions occurring via technology. Effectiveness of the coach-the-coach model is assessed using the SEE-KS™ (Rubin, E. et al., 2014) three-point rating scales. SEE-KS™ is a coaching framework based on Universal Design for Learning encompassing the principals of SCERTS® (Prizant et al., 2005).
Results:
SEE-KS™ subscales (Fostering Engagement, Presenting Information, and Allowing Child Expression) were generated by averaging corresponding items on the SEE-KS™ measure for each family at a baseline and follow-up time point per yearly quarter. Restricting the analysis to the first two quarters, mixed effects linear growth models were employed to determine if SEE-KS subscales significantly changed both within quarters and at baseline across quarters. Results show a significant change from baseline to follow-up within each quarter across all subdomains (all $p<0.05$) (See Table 1) and baseline for quarter 2 being higher than baseline at quarter 1 across all subdomains, though not significantly. The overall trends over time are all highly significant ($p<0.001$) which indicates a significant provider improvement over time (See Figure 1).
Conclusions:
These data indicate that the current coach-the-coach model resulted in caregivers providing increased supports to promote engagement, understanding, and expression in toddlers at risk for ASD. Through the use of innovative technology within the coach-the-coach model, EIPs were able to build caregiver capacity to implement supports and empower caregivers to utilize evidence-based supports. And though insignificant, the increasing baseline scores between quarter 1 and quarter 2 show that the EIPs are generalizing these skills from one family to the next.

270 **127.270** Variables Associated with Services Sought By Caregivers of Individuals with Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) is a neurodevelopmental disorder commonly seen with language impairment, intellectual disability, medical conditions, and psychiatric disorders. Currently, a myriad of treatment options are available, reflecting the phenotypic heterogeneity within ASD. Treatment barriers in ASD are well established in literature and access to services can be impacted by patient, family, provider, and policy-level factors. Another important factor for optimal treatment may include treatment choices made by families caring for individuals with ASD.
Objectives: To explore potential child and familial demographics associated with treatments sought by families caring for individuals with ASD.
Methods: Parents of individuals with ASD completed online survey questions related to services sought. The services were categorized under four service groups: Educational, Mental Health (MH), Medical Services (MED), and Complementary and Alternative Medicine (CAM). Data were analyzed using IBM Statistical Package for the Social Sciences 20.0 (SPSS). Descriptive information was obtained by computing frequency statistics for the sample to gather basic demographic information and number of services of sought. Chi-square tests were used to measure differences in services sought by individual characteristics including gender, diagnosis, and race, as well as family characteristics such as family income, insurance, parental education, and parental employment.
Results: On average, families sought approximately 8 services. Significant differences in the number of services sought were seen in diagnosis, race, and parental employment. Individuals with ASD and comorbid psychiatric conditions sought more services than ASD alone. Asians sought the least number of services and Caucasians sought the most number of services. Lastly, families with employed parent(s) sought more services compared to families with unemployed parent(s). The type of services sought by families varied by child gender, diagnosis, race, parental employment status, and having private insurance. Caregivers of male individuals with ASD sought Educational and Medical services at a higher rate relative to females. Individuals with comorbid psychiatric conditions sought more Educational, MH, and MED services than ASD alone. Asians were least likely to seek MH services while Caucasians were most likely. For medical services, African-Americans sought more MED services. Families with employed parent(s) sought more Educational, MH, MED, and CAM than families with unemployed parent(s). Lastly, having private insurance increased the rate of Educational, MH, and MED services seeking behavior.
Conclusions: Results suggest diagnosis, race, and parental employment may influence the number of services sought by families caring for individuals with ASD. Furthermore, the type of services sought may be differentiated by gender, diagnosis, race, parental employment status, and having private insurance. Overall, there seems to be significant variability in treatment choice and utilization among families caring for individuals with ASD. Little is known on how families decide on which services to use, but is likely a complicated process with many factors influencing their decisions. Our findings suggest culture-specific variability in service seeking behavior, and a role for culturally sensitive diagnostic and educational programs in minority communities to reduce disparities and improving awareness about ASD-related treatment.

271 **127.271** What Autism Spectrum Disorder Services Do Families Want? : Results of a Brief Quality Improvement Survey in a Hospital-Based Outpatient Clinic

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Background: Research consistently demonstrates that children with Autism Spectrum Disorder (ASD) require intervention to support their cognitive, language, social, and educational development (Reichow & Volkmar, 2010). Additionally, the quality and quantity of services available for children with ASD (Dawson, 2008) has continued to increase. However, caregiver satisfaction regarding their access to services and participation in services has remained moderately low (Brookman-Frazee et al., 2007). Thus, to improve caregiver satisfaction with services, increase family participation, and plan for future program development, better understanding of caregiver feedback regarding desired treatment services and possible barriers to participation in services is needed.
Objectives: Although there are a wide variety of interventions available for children with ASD, minimal research has investigated which of the various treatment services caregivers are most interested in having their child participate in through an outpatient setting. Thus, the aims of the study were to: 1) assess the types of services that caregivers reported an interest in; 2) assess caregiver-reported barriers to participating in services; and 3) assess caregiver awareness of the services available at an outpatient clinic.
Methods: Following participation in either an evaluation or a treatment session with one of two specific ASD providers in an outpatient clinic, caregivers of children diagnosed with ASD (n = 28) completed a questionnaire developed by the clinicians that assessed caregiver interest in, barriers to, and awareness of various treatment services available in the outpatient clinic. Demographic information was also gathered via the questionnaire.
Results: Demographic information indicated that the majority of children with ASD were male (M=26, F=2). The average age of the child with ASD was 7 (age range 2-15 years). While the majority of caregivers reported an interest in receiving behavior management treatment services (64.29%) and participation in social skills groups (60.71%), nearly half of the caregivers (46.43%) also expressed interest in additional written materials about ASD (see Table 1). Regarding barriers to services offered, time of day, childcare, and concern services will not meet the needs of the child were of similar difficulty (21-28%) for caregivers (see Table 1). Regarding awareness of services offered, the majority of caregivers reported being aware of the following services: Behavior Management (82.1%) and Evaluations (78.5%). However, less than half of the caregivers reported an awareness of the following services offered: parent training, parent support, medication management, cognitive behavior therapy (CBT), and speech services.
Conclusions: The preliminary results of this study suggest that there are cost-effective ways, such as providing increased written materials and education by the outpatient provider, to assist families with accessing desired services and stresses the importance of increasing caregiver awareness of available services. These results will guide program development to ensure that written materials and visibility of services offered are prioritized by the outpatient clinic to meet the needs of caregivers.

272 **127.272** Young Adults on the Autism Spectrum: Lost in the Services Maze

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Background: National surveys suggest many young adults with autism spectrum disorder (ASD) are left without adequate services once they leave high school. However, little is known about what actually transpires as families try to access services for their adult children with ASD.
Objectives: To explore experiences of young adults with ASD and their families related to availability, quality, and appropriateness of services post high school.
Methods: Qualitative interviews addressing post high school experiences were conducted with 35 parents and 14 young adults with ASD. Interviews were transcribed; material relating to publicly funded services was segregated, then coded using a grounded theory approach.
Results: Three major themes emerged from families' narratives: *Information and Access*, *Program and Staff Issues*, and *Young Adult Characteristics and Fit*. ***Information and Access:*** Families were often bewildered by the overwhelming array of adult services. High schools did not always guide families through this labyrinth. Young adults had first to qualify for services and then be accepted by a service-providing agency. Those who had severe behaviors (e.g. aggression, elopement) had trouble finding a willing provider, while those who were more cognitively able rarely qualified. Youth who graduated from high school with typical peers faced a major gap. A young man with ASD: *"I was at home for like three years because we couldn't find anywhere for me to go….Â I graduated at 17..., and a lot of the agencies nowadays -- you have to be 21."* ***Program and Staff Issues:*** Programs, which varied greatly in quality, had seldom been designed with ASD in mind. They were generally underfunded; low pay, high turnover, and a lack of ASD-related knowledge among staff were common. Formal goals frequently went unmet, and there was little accountability. A mother: *"I called a meeting and I was like… 'You are supposedly getting money to provide services for my son…. I come and find he is standing in the rain for 20 minutes because you have him on some inappropriate assignment, no support, and nothing that is really helping him to get a job.'"* ***Young Adult Characteristics and Fit:*** Young people with ASD and their parents struggled to characterize where they were on the spectrum and what this meant with regard to needed services. Parents of those with intellectual disability feared little thought was being given to future potential, while parents of the cognitively able were distressed that little help was offered to address ASD-specific challenges. Co-occurring medical or mental health concerns complicated matters for individuals across the spectrum. The mother of a daughter with a high IQ and psychiatric issues: *"I reach out to the Developmental Disabilities Administration, to these people, to those people… she doesn't fit the box. She's not mentally ill enough, she's not disabled enough."*
Conclusions: Young adults with ASD and their families bear a substantial burden as a result of lacking or inappropriate services. A better understanding of gaps and issues confronting families, and how these differ according to young adult characteristics, may inform efforts to improve policies and practices.

273 **127.273** Cross-Cultural Family Perspectives on Early Detection of ASD

A. Evans[1], *A. Delehanty*[2], *R. R. Grinker*[3], *S. Mazzatenta*[2], *J. Brown Speights*[4], *T. Walton-Walker*[2], *I. Davis*[5], *G. Ranger-Murdock*[6], *J. Boucher*[7] *and A. M. Wetherby*[2], *(1)National Black Church Initiative, Washington, DC, (2)Florida State University Autism Institute, Tallahassee, FL, (3)George Washington University, Washington, DC, (4)Florida State University College of Medicine, Tallahassee, FL, (5)Florida State University, Tallahassee, FL, (6)Cornell University, Ithaca, NY, (7)CADB, Ossining, NY*

Background: Although early social communication delays may be observable by 18-24 months, most children are not diagnosed with autism spectrum disorder (ASD) until 4-5 years of age. Children from minority or underserved backgrounds are identified 1-2 years later restricting access to early intervention. African American children are frequently misdiagnosed with other neurodevelopmental or emotional behavioral disorders and are underrepresented in intervention research (Hilton et al., 2010; Mandell et al., 2005; 2007). Among Latino children, healthcare professionals may be unable to conduct screening in the family's native language, and they encounter a lack of accessible specialists (Magaña et al., 2015; Zuckerman et al., 2013). Families from minority backgrounds may experience limited resources, socioeconomic variables, varying family interpretation of symptoms related to cross-cultural norms, and lack of trust and partnership with health professionals (Burkett et al., 2015; Grinker et al., 2011). The AAP recommends prioritizing research addressing health disparities in timely access to diagnostic and treatment (Cheng et al., 2010).
Objectives: To describe qualitative research findings from focus groups with diverse families implemented to identify challenges and barriers to early detection and access to care for toddlers under 24 months.
Methods: The research team contacted agencies serving young children and faith-based organizations through the National Black Church Initiative (NBCI). Focus groups were conducted in urban regions of Florida, Georgia, Pennsylvania, and New York. Separate groups were held for parents, grandparents, and parents of children at-risk for developmental delay. There were 105 participants in 8 focus groups; 70% black, 30% white, and 15% Hispanic. Driven by a grounded theory approach, researchers analyzed transcripts of audio-recordings to identify emergent thematic patterns. Multiple sites and diverse stakeholder viewpoints allowed for increased dimensions of variation and saturation of themes. Four members of the research team belonged to minority backgrounds represented in the sample, and verified that inferences were grounded in the data.
Results: Seven cross-cultural perspectives emerged for in-depth inquiry: 1) historical inequalities impact trust, prompting caregivers to view extended family as first-tier medical authority; 2) assumptions made based upon race, ethnicity, home language, and gender result in lack of a distinct call to action when toddlers show signs of ASD and communication delays; 3) people who speak languages other than English may expect children to have delays; 4) cultural beliefs and judgments of mainstream medical services, and need to keep diagnosis and treatment from extended family; 5) desire that others recognize child's worth and value in the presence of their disability, 6) role of spirituality to understand and cope with child's disability and the church as a place safe from stigma; and 7) increased role of supportive extended family members may serve as protective shield and help interventions fit family lifestyle.
Conclusions: Professionals should be aware of personal biases that may create obstacles for underserved families. To facilitate family engagement and connections to resources, professionals should consider ASD through each family's cultural lens, utilize evidence-based family-centered practices such as motivational interviewing, understand environmental stressors, and support caregivers' advocacy competencies (Ennis-Cole et al., 2013; Ingoldsby, 2010).

274 **127.274** Physicians' Perspectives on Early Screening and Diagnosis of ASD: Challenges and Solutions in Diverse Communities

R. Turchi[1], *J. Brown Speights*[2], *A. Delehanty*[3], *S. Mazzatenta*[3], *L. Orsini*[1], *E. Kaiser*[4], *J. L. Stapel-Wax*[5], *D. L. Robins*[6], *S. Dufek*[7] *and A. M. Wetherby*[3], *(1)Drexel University, Philadelphia, PA, (2)Florida State University College of Medicine, Tallahassee, FL, (3)Florida State University Autism Institute, Tallahassee, FL, (4)Marcus Autism Center, Atlanta, GA, (5)Emory University School of Medicine, Atl, GA, (6)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (7)Weill Cornell Medical College, White Plains, NY*

Background: The AAP recommends developmental surveillance at all pediatric visits and ASD-specific screening at 18 and 24 months (Johnson et al., 2007). Surveys of healthcare professionals suggest tremendous variability in the rates at which clinicians follow these guidelines (Dosreis & Weiner, 2006; King et al., 2010; Pierce et al., 2011; Self, Parham, & Rajagopalan, 2015). Barriers to implementation of universal screening include integrating screening into work flow, time constraints, electronic health records, and training needs (Crais et al, 2014; King et al., 2010). There is a need for research further illuminating the challenges faced by physicians and other healthcare providers in low- and high-resource settings and solutions to increasing accurate screening, diagnosis, and referral to early intervention.
Objectives: To present qualitative research findings from focus groups with physicians from diverse metropolitan areas across the U.S., designed to 1) identify barriers to early detection and access to early intervention for children under 24 months, and 2) develop strategies to increase physicians' confidence in identifying early signs of ASD, communicating with families, and accessing early intervention services in underserved communities.
Methods: Five focus groups with 45 primary care physicians and nurse practitioners were conducted in diverse regions of Florida, Georgia, and Pennsylvania. Driven by an iterative, grounded theory approach, researchers analyzed transcripts from audio-recordings using inductive coding. The use of multiple sites and diverse stakeholder viewpoints allowed for increased dimensions of variation and for saturation of themes. Physicians on the research team verified themes were grounded in the data, inferences were accurate, and that researcher bias did not interfere with interpretation.
Results: Illustrative quotes were drawn from diverse topics surrounding four major themes: 1) physician-perceived practical and psychological/motivational family challenges to accessing resources and services, including lack of medical follow-up, time constraints, and reimbursement issues; 2) efficient, effective tools for screening and assessment of ASD, including the utility of current tools, difficulty evaluating ASD in the primary care setting, and a perceived lack of reliable tools that would simplify diagnosis in the absence of available biomarkers, 3) the role of the primary care physicians in ASD screening and diagnosis, including confusion related to responsibilities of pediatricians and specialists who may be serving a population of varying cultural backgrounds; and finally, 4) strategies for building trust—the need to express empathy and offer hope to families, addressing parents' questions about causality, vaccination, and complementary and alternative medicine to treat ASD, and concern about parents/caregivers switching physicians when ASD is mentioned.
Conclusions: Topics for further inquiry include physicians' suggestions for refinement, including family navigation, continuity of care, a process-oriented approach to diagnosis of ASD, policy improvements, a team-centered medical home, a variety of media for reaching families, and the need for widespread physician training on ASD.

275 **127.275** Engaging Community Service Providers to Improve Earlier Autism Screening and Detection

J. L. Stapel-Wax[1], *E. Kaiser*[2], *L. Orsini*[3], *S. Mazzatenta*[4], *K. Traub*[5], *M. Costo*[2], *T. Gaines*[2], *D. L. Robins*[6], *S. Dufek*[7], *G. Ranger-Murdock*[8], *J. Boucher*[9], *C. J. Newschaffer*[6], *A. Klin*[10], *C. Lord*[11] *and A. M. Wetherby*[4], *(1)Emory University School of Medicine, Atl, GA, (2)Marcus Autism Center, Atlanta, GA, (3)PA Chapter of the American Academy of Pediatrics, Media, PA, (4)Florida State University Autism Institute, Tallahassee, FL, (5)AJ Drexel Autism Institute, Philadelphia, PA, (6)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (7)Weill Cornell Medical College, White Plains, NY, (8)Cornell University, Ithaca, NY, (9)CADB, Ossining, NY, (10)Marcus Autism Center, Children's Healthcare of Atlanta & Emory University School of Medicine, Atlanta, GA, (11)Psychiatry, Weill Cornell Medical College, White Plains, NY*

Background: It is important to build the capacity of community service providers to recognize the early signs of ASD in order to connect children to early intervention services to have the greatest impact on child and family outcomes. Community Based Participatory Research (CBPR) is used increasingly to address health issues and disparities for children by focusing on social, structural, and physical environmental inequities through active involvement of stakeholders, organizations, and researchers throughout the research process (Israel et al., 2001). CBPR can be used to address challenges to translational research including limited external validity, poor community trust in research, and lack of sustainability of practice change in community settings (Dankwa-Mullan et al., 2014).
Objectives: To utilize CBPR to engage community service systems in a new web-based professional development course and screening portal for social-communication delays and early signs of autism.
Methods: Community service providers (CSPs) from primary care practices, social services, and early learning centers were recruited to participate in this ongoing research. CSPs were invited to Autism Navigator for Primary Care, a web-based professional development course on the early signs of autism using video footage to rapidly build the capacity for early detection and understand how to share screening results with families. CSPs were provided with a tablet computer containing an interactive web platform with an automated screening tool linked to family resources on development and autism. Barriers to screening experienced by CSPs were identified through weekly communication that tapered to monthly over time. Feedback from CSPs was used to improve the screening process and potential access to care.
Results: To date, 158 CSPs have been recruited from 4 states in this multisite project, 121 from primary care and 37 from social service agencies; 138 CSPs have completed the coursework and screened 1,513 children by 18 months of age. It is anticipated that the number of CSPs and children screened will double in the next 6 months. Demographic information will be provided about CSPs in each service system. Barriers to screening experienced by CSPs and solutions to help CSPs incorporate practice change into their busy workflow will be reported. The most common barriers encountered include time to complete the course, understanding technology, and time to implement universal screening when many tasks must be completed during well-child visits. Strategies to address these barriers include contacting providers via e-mail and phone calls, weekly email blasts to highlight course content, improve user friendliness of portal, developing a briefer version of the course, meeting to troubleshoot problems, offering technical assistance, setting formal training dates and setting completion goals, promoting structured provider communication and partnership with other agencies, identifying staff members willing to engage family in screening while waiting for appointments, and enabling families to complete screening at home.
Conclusions: These findings will have important implications for bridging the research-to-practice gap and lowering the reachable age of early detection of ASD. Screening by different community service systems provides the opportunity to study strategies to address health disparities in access to early screening, diagnosis, and care.

276 **127.276** Using Tailored E-Mail Messages about Social Communication Milestones and Autism Spectrum Disorder to Engage Professionals in Autism Navigator® for Primary Care

A. Delehanty[1], *J. Warrick-Imrisek*[2], *N. D. Rich-Wiseman*[3], *D. Jones-Ellis*[1], *S. Barnes*[1], *C. North*[1] *and A. M. Wetherby*[1], *(1)Florida State University Autism Institute, Tallahassee, FL, (2)Florida State University College of Medicine, Tallahassee, FL, (3)Florida State University College of Medicine, Bedford, MA*

Background: The AAP and other professional organizations maintain a strong commitment to screening all children for autism spectrum disorder (ASD) at 18-24 months; yet, a recent USPTF report found inconclusive evidence to support universal screening in primary care prior to parents' expression of concerns. Pediatric healthcare professionals and families may be familiar with infants' motor milestones, but less aware of early social communication milestones and red flags for ASD.Â Bridging this research-to-practice gap is more critical than ever, and important steps include training professionals about screening, diagnosis, and evidence-based treatment.Â Researchers have investigated the utility of academic detailing, or educational outreach through professional development, to encourage physicians to change screening and referral processes (Honigfield, Chandhok, & Spiegelman, 2011; Soumerai & Avorn, 1990). Engagement with course material may be enhanced through the use of web-based tools. There is a need for research on the effectiveness of media message framing in encouraging professionals to complete coursework and change their screening and referral practices.
Objectives: The purpose of this study was: 1) to examine the responses of professionals enrolled in Autism Navigator® for Primary Care who received tailored e-mail messages about early social communication milestones and ASD; and 2) to characterize participants' perceptions of the messages.
Methods: Engaging weekly e-mail messages were developed through extensive efforts of an interdisciplinary team of autism researchers and specialists in marketing and public relations, user interface, and graphic design (Figure 1). Messages were framed to encourage course completion and utilization of a parent portal with automated screening linked to family resources. Participants were randomly assigned to one of two conditions based on e-mail message type. Gain-framed message highlighted the benefits of screening and awareness of early social communication milestones. Loss-framed e-mails stressed the risks or costs of not being aware and not screening (Tversky & Kahneman, 1981). Website analytics were used as a metric to examine relations between click-through rates and course activity. Participants were invited to respond to a brief, online survey to explore their perceptions of the messages.
Results: Data collection is ongoing. The mean open rate for messages to date is 36%. The click-through rate was 16% for gain-framed and 15% for loss-framed messages. In the 5 weeks since the email campaign began, there has been a 54% increase in course activity completion. Professionals varied in their perceptions of messages and offered suggestions for refinement.
Conclusions: E-mail engagement was higher than rates reported in the education and training industry, where average open and click-through rates hover between 16-22% and 3-6%, respectively (Chaffey, 2016; Constant Contact, 2016). Receiving informative messages about ASD and social communication delays was associated with upward trends in users' activity in a professional development course. This study demonstrates how media messaging and data analytics can be used to monitor and engage distance learners in course utilization and completion. These findings will inform further academic detailing efforts, and add to research on web-based tools and strategies for tailoring messages that encourage professionals to translate new knowledge into practice.Â

277 **127.277** Employing Process Maps to Identify Provider- and Site-Variation in Screening for Autism Spectrum Disorder

T. I. Mackie[1]*, C. Tan*[2]*, J. Benneyan*[3]*, R. C. Sheldrick*[4] *and M. Sridhar*[5]*, (1)Institute for Health, Health Care Policy and Aging Research, School of Public Health, Rutgers University, New Brunswick, NJ, (2)Brandeis University, Waltham, MA, (3)Northeastern University, Boston, MA, (4)Tufts Medical Center, Boston, MA, (5)Robert Wood Johnson Medical School, Rutgers University, New Brunswick, NJ*

Background: Â Challenges in moving scientific evidence into practice and policy are well-documented in the identification and treatment of autism spectrum disorder (ASD), especially for historically underserved communities. One factor thought to contribute to this translational lag is the time it requires to move a traditional research program from investigation of efficacy to effectiveness to implementation. To expedite the traditional research program, health services researchers are increasingly employing effectiveness-implementation hybrid designs that take a dual focus *a priori*on effectiveness and implementation. Blending these approaches into a single design is hypothesized to improve "clinical utility" of the study for practicing clinicians and decision makers.Â We demonstrate the value of a multi-method qualitative study that employed process maps- a systems-level visualization of the process logic and flow- to investigate fidelity and process efficiency of a three-stage screening process.
Objectives: We present how the use of multiple qualitative methods informed the development, validation, and application of process maps, with implications for improvements in fidelity and process efficiency of the intervention protocol.
Methods: We employ multiple qualitative methods to assess fidelity and process efficiency in the protocol for a three-stage ASD screening process. To improve the validity of process maps, we utilized respondent triangulation through inclusion of multiple samples, specifically: (1) research staff who developed and supported intervention approach (n=10), and (2) EI service providers who administered the two stage screening (n=21). All participants were asked to develop a process map of the screening process from point of initiation until time of completion. For trainers, we then conducted two concurrent focus groups to develop independent process maps and a subsequent member-checking focus to reconcile differences and validate findings. For EI providers, process maps were created during semi-structured interviews. Once collected, we individually analyzed trainer and EI provider process maps, coded, and summarized themes regarding protocol adaptation and provider variation.
Results: Â Comparing process maps of research staff and EI providers revealed considerable variation in adaptations made to the multi-stage screening protocol. For example, while the process maps generated by research staff illustrated initiation of the process to be when screening tools were distributed to providers, the process maps from EI providers demonstrate multiple non-scripted criteria to initiate or deter the process, including (1) whether the EI service provider, other clinical team members, or parents expressed concerns for ASD, (2) assessment of parental readiness to discuss ASD, and (3) assessment of family's service delivery needs and priorities. After initiation of the screening process, maps also revealed variation in how providers present ASD concerns indicated by the screening tools and the extent to which they expedited the process for further evaluation or relied on the family to move the process to subsequent screening stages.
Conclusions: Our findings suggest considerable adaptation occurred to intervention protocol, but systematic investigation of adaptations provides opportunity for protocol enhancement and training. Results reported above, for example, calls for additional EI service provider training in a shared decision-making process that encourages meaningful family engagement while minimizing delays to diagnosis during this critical developmental period.

278 **127.278** Pathways to Autism Spectrum Disorder Diagnosis through a Multi-Stage Screening Process

E. Frenette[1]*, N. A. Hoch*[1]*, J. D. Vera Jones*[1]*, T. I. Mackie*[2] *and C. Tan*[3]*, (1)University of Massachusetts Boston, Boston, MA, (2)Institute for Health, Health Care Policy and Aging Research, School of Public Health, Rutgers University, New Brunswick, NJ, (3)Brandeis University, Waltham, MA*

Background: For Autism Spectrum Disorder (ASD), evidence suggests that early screening improves detection rates. Our team implemented a multi-stage screening protocol for ASD in Early Intervention settings based on the “clinical reasoning model.”Â According to this protocol, referral decisions were based on screening results and the expressed clinical concern from parents or Early Interventionists. That is, children were promoted to successive stages if screening results were positive or clinical concern was reported subsequent to screening.
Objectives: Â To assess the utility of *a posteriori*concern-based referrals for ASD within Early Intervention settings and conduct a basic cost/benefit analysis of this multi-stage screening process.
Methods: Â 1022 children between the ages of 14-33 months participated in a case finding process for ASD involving stage 1: parent-report questionnaires, stage 2: structured observations, and stage 3: full diagnostic assessments. Quantitative methods were used to assess the effectiveness of different diagnostic pathways. Qualitative interviews of providers (N=20) were conducted to understand factors that influence their decision making processes.
Results: Among children with positive screening results, parents and/or Early Interventionists were concerned 64% of the time. The most efficient pathway to diagnosis was a positive screening score at stage 1 along with reported concern [5.6 assessment hours/diagnosis]. The least efficient pathways were those in which there were positive screening scores but no reported concerns [11 assessment hours/diagnosis]. Notably, pathways in which the stage 1 screening was negative but there was at least some reported concern fell in the middle [7.5 assessment hours/diagnosis]. Qualitative results suggest EI interventionists employed dynamic and distinct strategies to move families through the three-stage screening process when clinical concerns, whether the parents or their own, are present.
Conclusions: Results demonstrate the value of allowing referrals based on clinical concern subsequent to screening. Although, it is unclear the degree to which screening results influenced these concerns (concerns were coded after stage 1 screening results and are therefore not independent). Results also highlight that Early Interventionists find value in screening that go beyond the psychometrics of the binary result to include instruments' ability to enhance conversations and to collect clinically meaningful information about observed behavior within natural settings. These data show how important screening is and how crucial it is that we do not solely rely on parent concern in drawing conclusions about the value of ASD screening. If screening does not occur until parents are concerned, opportunities will be missed to diagnose children and therefore limit their chance to receive high intensity services at a younger age.

Oral Session -
134 - Welcome Address & Sponsor Update
8:45 AM - 9:00 AM - Yerba Buena 8-9

8:45 Welcome Address & Sponsor Update

Keynote Address
135 - Engaging Autism: Interventions for Improving Social Communication Outcomes
9:00 AM - 10:00 AM - Yerba Buena 8-9

Speaker: C. Kasari, University of California, Los Angeles, Los Angeles, CA

Early interventions for children with ASD have resulted in greater numbers of children entering mainstream settings, and fewer children entering school as minimally verbal. While we have several effective behavioral interventions, heterogeneity in response to treatment remains a significant challenge. Our approach to addressing heterogeneity and response to treatment has been 1) the development of targeted and modular interventions that address core areas of impairment in children with ASD, and 2) methodologies that address response to intervention with the goal of personalizing treatment. This talk will describe our work in applying targeted interventions for improving social communication outcomes across a range of developmental ages, delivered in authentic community settings, and mediated through multiple individuals. Underserved, and under-represented groups of children will be highlighted, including minimally verbal school aged children, and girls, as well as methods for systematically adapting interventions based on child response. To further the goal of personalized treatment, future challenges center on greater specification of the active ingredients of interventions, and individual differences in predicting response to treatments.

9:00 Engaging Autism: Interventions for Improving Social Communication Outcomes

***C. Kasari**, University of California, Los Angeles, Los Angeles, CA*

Early interventions for children with ASD have resulted in greater numbers of children entering mainstream settings, and fewer children entering school as minimally verbal. While we have several effective behavioral interventions, heterogeneity in response to treatment remains a significant challenge. Our approach to addressing heterogeneity and response to treatment has been 1) the development of targeted and modular interventions that address core areas of impairment in children with ASD, and 2) methodologies that address response to intervention with the goal of personalizing treatment. This talk will describe our work in applying targeted interventions for improving social communication outcomes across a range of developmental ages, delivered in authentic community settings, and mediated through multiple individuals. Underserved, and under-represented groups of children will be highlighted, including minimally verbal school aged children, and girls, as well as methods for systematically adapting interventions based on child response. To further the goal of personalized treatment, future challenges center on greater specification of the active ingredients of interventions, and individual differences in predicting response to treatments.

Poster Session
136 - Technology Demonstration
10:00 AM - 1:40 PM - Golden Gate Ballroom

1 **136.001** A Researchkit App with Automatic Detection of Facial Affect and Social Behaviors from Videos of Children with Autism

***J. Hashemi**[1], K. Campbell[2], S. Espinosa[1], S. Marsan[3], Q. Qiu[1], M. Tepper[1], K. Carpenter[3], J. Schaich Borg[1], G. Dawson[3], R. Bloomfield[1], H. Egger[4] and G. Sapiro[1],*

(1)Duke University, Durham, NC, (2)Duke Center for Autism and Brain Development, Durham, NC, (3)Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC, (4)Child and Adolescent Psychiatry, NYU Langone Medical Center, New York, NY

Background: The gold standard for Autism Spectrum Disorder (ASD) screening involves parental reports of child behaviors. Few screening methods are scalable and incorporate objective data. Wide use of mobile devices that can both display and collect text and video data provides an opportunity for testing new screening methods that are feasible beyond the clinical setting. Naturalistic observation can now be quantified with computer vision techniques and could have applications in detecting subtle behavioral abnormalities.
Objectives: To create and test a self-contained mobile application that allows for remote collection of ASD-specific questionnaire data, observational video data of a child reacting to various video stimuli while in his/her natural environment, and automatic coding of observational video data.
Methods: The ResearchKit app *Autism&Beyond* was developed and launched as a study with informed consent and IRB oversight. The app incorporates demographic questionnaires and a digital version of the full Modified Checklist for Autism in Toddlers (M-CHAT-R/F) including follow-up questions. In addition, three short video stimuli (bubbles, rhymes and toys, and a bunny) as well as a mirror stimulus are presented to elicit affective and social responses. Using the front facing camera on the mobile device, video of the child is recorded during stimulus presentation and saved at 640 by 480 resolution and at 15 frames per second. Developed computer vision algorithms automatically detect and track multiple facial landmarks including points around the eyes, nose, and mouth. From the tracked facial landmark locations, multiple characteristics are gathered including head position, head orientation, facial affect classification, and blink rate. Responses to stimuli were analyzed separately to determine whether stimuli differentially elicit child behavior.
Results: Over six months of data collection, 878 subjects met the inclusion criteria (at date of abstract submission we have registered over 2,000 consent forms, over 5,000 video recordings, and over 8,000 completed surveys and questionnaires). Of these, 152 children 1-6 years old with parent-reported Autism diagnosis and/or high risk M-CHAT score uploaded video data through the mobile application. The child's face was detected on average during 84-92% of the video stimulus, with the most face detection in the rhymes stimulus. Computer vision algorithms classified positive affect during a mean of 22-31% of the total time, with the most positive affect detected during the mirror stimulus. Using head position, social referencing occurredÂ for 12-42% of subjects throughout the various stimuli, with greatest probability of social referencing observed during the Mirror stimulus.
Conclusions: We developed and deployed a mobile application to gather ASD-specific questionnaire and video data in naturalistic settings. From the video data we were able to automatically score affective and social responses of a child during various video stimuli. Application of computer vision to facial expression analysis could lead to new behavioral imaging methods for detecting subtle neurologic processes relating to attention and emotional expression, and may be useful for early Autism screening and monitoring.

2 **136.002** A Smartphone Application to Measure Response to Name in Everyday Environments

R. P. Thomas[1], *L. A. Wang*[1], *J. Miller*[2], *J. W. Pennington*[2], *S. Hassan*[2], *A. Grasmeder*[2], *J. Swanick*[2], *N. Minyanou*[1] *and J. Miller*[3], *(1)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (2)Department of Biomedical and Health Informatics, The Children's Hospital of Philadelphia, Philadelphia, PA, (3)The Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA*

Background: Â Reduced response to name is a hallmark feature of Autism Spectrum Disorder (ASD) but our current methods of identifying it are not very sensitive. Measurement of response to name is often qualitative, relying on the child's performance during an in-person evaluation (ADOS) or a yes/no response on parent questionnaires (M-CHAT). Measured as a quantitative variable, or as a *rate*of responding rather than a dichotomous summary judgment, response to name may be both a more sensitive indicator of ASD and a potential moderator of response to treatment.
Objectives: Â The objective of the study was to develop a smartphone application to record children's response to name in everyday environments.Â We examined fidelity, accuracy of parent ratings, and user experience.
Methods: Â Parents of children between the ages of 18-48 months participated in the study. Children could be typically developing, or have ASD or another developmental concern. Parents downloaded the app onto their smartphone and were asked to complete 3 sessions. The app included a built-in tutorial; otherwise no instructions were provided. The tutorial displayed illustrations and text guiding parents to stand 3-5 feet behind the child, call the child's name once, and then press Yes or No to rate whether the child responded. Within each session, the app prompted up to 3 name call trials in case the child did not respond right away. After 3 sessions, we provided feedback to the parent about fidelity. Then parents were asked to record up to 30 additional sessions over the course of one week. Sessions were automatically uploaded to our database, with both a video file and time-stamped text file of parent ratings. After completing all sessions, parents completed online questionnaires about user experience and satisfaction.
Results: Â So far, 4 families have begun participation, and 17 more have expressed interest (study goal is 30 families). We currently have 16 pre-feedback trials and 135 post-feedback trials. Two raters viewed each video recording and text file to establish parent fidelity (the parent's ability to administer the trial correctly) and accuracy (of child response ratings). Inter-rater agreement was 100% for fidelity and 98% for accuracy. Across participants' first three sessions, parent fidelity averaged 78% (range 50%-100%). Two families needed feedback to say the child's name only once, and not to shout the child's name. Across post-feedback trials, parent fidelity averaged 89% (range=77%-97%).Â Parent accuracy for rating their child's response was 97% (range=95%-100%).Â Parent survey responses indicated parents "strongly agreed" the app was easy to use, that it measured a meaningful behavior, and that they would recommend the app to a friend.
Conclusions: Â The app appears easy for parents to use correctly, though instructions do need to highlight calling the child's name only once and not shouting the child's name. Ongoing data collection will allow us to also develop formulas for calculating a child's rate of responding, which can then be examined across children with ASD, other delays, and typical development.

3 **136.003** A Mobile Video Game for Studying Social and Nonsocial Executive Functions in Children with ASD

B. Li[1], *Y. A. Ahn*[2], *M. Kim*[3], *M. Mademtzi*[4], *S. A. A. Chang*[5], *E. Barney*[6], *C. Foster*[4], *M. Best*[5] *and F. Shic*[3], *(1)Seattle Children's Research Institute, Seattle, WA, (2)Seattle Children's, Seattle, WA, (3)Center for Child Health, Behavior and Development, Seattle Children's, Seattle, WA, (4)Yale Child Study Center, New Haven, CT, (5)Yale University, New Haven, CT, (6)Child Study Center, Yale University, New Haven, CT*

Background: Deficits in executive functioning skills (EFS) is a characteristic for autism spectrum disorder (ASD). Clinicians often use traditional behavioral assessment (e.g. Wisconsin card sorting task) to test children's EFS, but these resources are not easily accessible for children living in undeveloped areas. Digitalized games have the potential to be a supplementary tool in increasing the accessibility of EFS assessments.
Objectives: To (1) design a well-controlled mobile technology game that can assess and potentially improve EFS in children with autism,using social and nonsocial conditions that test EFS; (2) To conduct a proof of concept usability test of the game.
Methods: We designed a tablet video game with three tasks: set shifting, working memory, and inhibitory control tasks. The program selects either social and nonsocial stimuli as targets for each session of the task, and each session has two social blocks and two nonsocial blocks (randomly counterbalanced). Similar to the Wisconsin card sorting task, our shifting task shows four images on the screen for each trial, and users have to guess which image is the correct answer.he underlying unspoken rule (happy face, angry face, red fractal, or blue fractal) changes for every ten trials.Â The working memory task shows objects for 10 seconds for participants to memorize, and then they have 45 seconds to choose all the right answers.The difficulty of the task depends on the participants' performance. For inhibitory task, users are asked to click as many pictures as possible on the screen, but are required to stop touching the screen when a "stop sign" or "angry face" pop out. The stop signal appears 5 times in each session. The appearance time and appearance length of the "stop (signal)" are pseudo-randomized and counterbalanced.Â Users' touches are recorded for post-hoc analysis.
Results: A supervised 6-year-old child with autism played all three tasks in 8.5 minutes. Throughout the experiment, the child touched the targets for a total of 74 times. In the shifting game, the child answered 17 out of 40 questions within the 2 minute time limit. He learned the first hidden rule and gave correct answers for the first 9 questions but failed to learn the new rule afterwards and got half of the questions wrong. In the inhibitory game, the child touched 44 targets in total and four of those occurred during the inhibitory stage. Of the four, three occurred during the social trials. In the memory game, the child spent an average of 1.99 seconds finding the memorized images during the two nonsocial trials. However during the two social trials, the child could not remember the correct target before reaching the time limit of 45 seconds.
Conclusions: This video game could be useful for examining discrepancies between socially-oriented and non-socially oriented executive function ability in children with ASD. In the future, we will collect more data from TD children, children with ASD, and TD adults. We will analyze and compare playing patterns, performance, and verbalization of each participant.

4 **136.004** Novel and Surprising Touchscreen Game Elements Can Motivate Spontaneous Communication from Children with Autism

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Background: A core characteristic of autism is difficulty with social communication and interaction, particularly initiating new communications. This research uses touch-screen computer games as a means to motivate practice of spontaneous initiations. The current games deliberately try create situations that children will perceive as subjectively novel or surprising (i.e. *discrepant,* differing from their current knowledge and expectations), and that are "worth communicating about" to others. In a previous project (the ECHOES virtual environment), autistic children were observed to frequently and spontaneously initiate about events of this type. ECHOES deliberately included novelty (e.g. new digital objects), however, software errors also caused *unintentional* surprises, such as the character making "mistakes" in an activity he had previously demonstrated correctly. The new designs *deliberately* alter a game environment and introduce new elements, trying to re-create and extend the type of spontaneous initiations fortuitously present in ECHOES.
Objectives: Evaluate a new set of games to determine whether deliberate inclusion of novel and surprising elements can motivate spontaneous, positive initiations about game content, similar to the interactions seen in ECHOES.
Methods: Three new games were developed, based on the simple, exploratory, cause-and-effect play in the original ECHOES environment. In one, children sorted apples by colour; two centred on growing flowers or carrots by shaking a magic cloud. Each game had a "baseline" and a "discrepant" version. After the baseline versions were familiar to children (session 1), additional objects and properties were introduced to create "discrepant" versions, with novel and surprising elements (sessions 2-3). Surprises included altered object appearances, sound effects, and timings between events. A character also made occasional "mistakes" with his actions and utterances. These things were predicted to interest children and pose opportunities for them to spontaneously initiate communication. A proof-of-concept scale school study in the UK (10 autistic children age 5-11 years, 2 female, phrase language use) evaluated the new games' effectiveness at motivating communication with an adult social partner. Children played the games individually, over 3 short sessions (mean 48 minutes total play /child).
Results: In 580 min of gameplay video, there were 409 spontaneous initiations to the adult researcher or game character, related to discrepancies (range 11-79 initiations, mean= 40.9/child). In an additional 241 instances, children reacted to discrepancies in a non-socially-directed way. 46% of these initiations were about game elements *deliberately* included to create discrepant (novel or surprising) situtations. Children also initiated about "non-designed" discrepancies: genuine system errors, and subjectively perceived changes or differences. Across all children, there were very few instances of negative affect. The games appeared both motivating, and emotionally manageable.
Conclusions: The current strategy of including novel and surprising game elements appears to have been successful in motivating spontaneous social communication for a diverse group of autistic children. It merits further investigation with a wider age/ability range, and with other types of technology. These findings are an early step towards determining whether this strategy may contribute to a future technology-based intervention for autism, capable of changing children's initiation behaviour outside of a game context.

5 **136.005** Using Positional Tracking to Monitor Gaze in VR - Pilot Study

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Background: The use of video as a tool to facilitate learning and skill development has undergone numerous iterations within this field and others, and its application has expanded to include eye-tracking and assessment to name only a few examples. More recently, 360 degree video has begun to enter the realm of mainstream media, in part as an accompaniment to the advent of virtual reality headsets (HMDs) as an affordable consumer product. In addition to their potential benefits to ecological validity (Cummings, Bailenson, & Fidler, 2012), the sophisticated positional tracking systems possessed by most commercial HMDs represents an opportunity to leverage this feature as an alternative measure of visual attention within VR environments. Evidence from both eye-tracking (Wang et al., 2015) and earlier work with HMDs (Jarrold et al., 2013) suggests that visual attention can be beneficially altered through interactive training and prompts. While currently limited to positional tracking, HMDs' stereoscopic 360° environments and real-time positional data makes them a viable and affordable candidate platform for interventions and assessments that would benefit from the ability to track visual attention.
Objectives: The first phase was conducted to 1) assess participants' level of comfort during extended use of HMDs, and 2) evaluate gaze as a measure of visual attention. Phase 2's primary goal: use these findings to inform the design of a background VR environment capable of 1) automatic data recording, 2) displaying playlists of 360° videos, and 3) providing a framework for custom stimuli setup.
Methods: Â Phase 1 consisted of 4 participants with a neurodevelopmental disorder(s) including ASD - both verbal and nonverbal (ages 6 to 18), and 2 TD participants (ages 5 to 11). Each participant watched five 360° videos varied across dimensions of social and physical intensity on an oculus DK2. Visual attention was defined as the central 25°s of the visible 100° FoV (Field of View) in the DK2. Questions and observations concerning comfort and overall enjoyment were recorded by a confederate. For phase 2, our initial approach was translated and modified within Unity, a popular game development platform.
Results: Â On average, participants spent 14 minutes and 21 seconds wearing the DK2, and responded positively during the session and to questions post-viewing. Notably, none of the participants with ASD paused or removed the headset, and only one TD participant briefly removed their headset during the "physical intense" 360° video (a rollercoaster ride). Results from the attention measure generally align with previous findings in the literature. Translation to Unity allowed for automatic data recording through a combination of Unity's Raycasting API and tagged "detection zones" for stimuli. Advantages included the removal of added time spent on data collection after setup and greater overall flexibility.
Conclusions: Â The initial evaluation of commercial HMDs for tracking attention and potential usability in applications and research targeting individuals with ASD is encouraging, however, further investigation is needed before concerns over sensory sensitivities are fully resolved. While the second phase of the project is still in development, progress and results from ongoing recruitment will be reported.

6 **136.006** Child-Directed Play-Based Identification of Sensory Preferences: A Report on the Sensory Toy Box Experience with ASD and TD Children

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Background: Sensory preferences of children with Autism Spectrum Disorder (ASD) are often unique from their peers, and it can be challenging to identify learning interfaces that promote engagement. The autonomous collection of data during a child's naturalistic play has the potential to provide unique insights into how children interact and engage with different sensory feedback modes. We developed and evaluated the Sensory Toy Box (Valencia, 2016), a device that can be activated in 9 different ways (through a button press, texture touch and/or placement of objects). The device logs each activation and provides different types of feedback in response such as sounds and light.
Objectives: 1) To enable direct identification of sensory preferences through a child-oriented play approach and 2) examine engagement within the different sensory feedback modes among typically developing (TD) and ASD groups.
Methods: We evaluated engagement and preferred activation and feedback modalities during 5-minute individual free play sessions with the Sensory Toy Box in a group of toddlers (M_{Age} =22.5 months, *SD* =7.9 months, TD *n* =3, ASD *n* =2) and school-aged children (M_{Age} =63.3 months, *SD* =20.1 months, TD *n* =2, ASD *n* =4). We used the Sensory Profile 2 (SP2) parent questionnaire to gather sensory profile information for reference. We collected data autonomously with the device and video-coded (ICC>=0.94) the interactions.
Results: Within our sample, children with ASD had higher engagement with the device (*M* =75.7% of time engaged, *SD* =17.5, *n* =6) than TD (*M* =50.5% engaged, *SD* =18.1, *n* =5), t (9) =2.45; p=0.038. When considering each age group separately, a significant difference was found only in the toddler group: ASD (*M* =81.6% engaged, *SD* =7.6, *n* =2) and TD (*M* =38.8% engaged, *SD* =6.3, *n* =3), p=0.0061. However, there was no significant difference among the group of school-aged children, ASD (*MÂ* =74.3% engaged, *SDÂ* =21.7, *nÂ* =4); TD (*MÂ* =68.1% engaged, *SDÂ* =14.3, *n* = 2), p>0.05. Children with ASD, both toddler and school-aged children groups, exhibited higher number of total activations in the visual feedback mode than the TD group. There was only a significant difference in the group of school-aged children for ASD (*M* =35, *SD* =9.8, *n* = 4) and TD (*MÂ* =5, *SDÂ* =4.2, *n* =2) groups, p =0.01. There was a significant correlation, between ASD diagnosis and engagement time (*rÂ* =0.63, *p* =0.037). Within the ASD group, number of activations during the auditory feedback mode were correlated with their SP2 auditory processing scores (*r* =0.60, *pÂ* =0.05) for both age groups. Participants with "Much more than others" auditory processing SP2 scores, performed 62% of their total activations during the auditory modality. No significant correlations were found for activations performed during the visual feedback mode and SP2 visual processing scores in both age groups.
Conclusions: In this work we have developed an initial prototype of an interactive technological tool to assist in the evaluation of sensory preferences in children with ASD. This preliminary study motivates further investigation in quantifiable measures of preferences and behaviors through child-directed play interactions with tangible toys.

7 **136.007** Evaluating the Effectiveness of a PRT Community-Based Autism Parent Coaching Program Using LENA

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Background: The gap between research and practice is wide despite increased awareness of the need to adopt evidence-based practices (EBP). A key component of effective ASD early intervention is parent coaching. Through partnership with community providers, real world implementation of parent coaching EBP's can be evaluated. Additionally, new technologies may help bridge the gap in community practice by simplifying feedback. Parent coaching in pivotal response treatment [PRT] (Koegel et al., 2006) is an EBP currently under dissemination in Western Canada. This study extends pilot work on using the Language Environmental Analysis System (LENA), a new technology, to provide feedback on a PRT parent coaching model in community practice (Stolte & Smith, in submission).
Objectives:

1. To provide an updated description of a community based pivotal response training (PRT) parent coaching model and extend previous findings
2. To evaluate the effectiveness of the model on child, parent and parent-child interactional communication patterns using the LENA
3. To evaluate the use of LENA as a new technology to measure program effectiveness in a real world setting

Methods: Using a non-concurrent multiple-baseline single-subject research design matched with new digital language processor technology (i.e., LENA), a community-based PRT parent coaching model was evaluated for pre-schoolers with ASD. Three parent-child dyads participated in a 5 week coaching model, 2 hours per week, producing 46 independent recordings. Using LENA Advanced Data Extraction (ADEX) software, baseline, intervention and follow-up data were evaluated on child, adult, conversational turns, and ratio of child initiated conversational turns. Detailed child and parent information, PRT fidelity, content validity, and functional relationships between coaching condition and communication patterns are appraised including video analysis and standardized communication measures.
Results: A program description and detailed parent and child information was obtained. Demonstration of PRT learning improved for all parents though only one parent met full fidelity. A functional relationship between adult language and coaching condition was identified for 2 of the 3 dyads. Functional relationships between conversational turns and coaching condition were inconsistent due to high variability, though 1 child improved in vocalizations over time. Visual analysis of 33,648 LENA communication blocks suggest child and adult initiations improved for 1 dyad, but was not replicated. Extracted LENA data on controlled conditions yielded distinct communication patterns across participants.
Conclusions: This PRT parent coaching model holds promise for community practice. By using new technology paired with single subject design methodology, detailed communication information and functional relationships could be evaluated over time. Extending previous findings, LENA analysis indicated replication of a functional relationship between coaching condition and adult word count for 2 of 3 dyads. All parents demonstrated improvement in PRT though fidelity was inconsistent. Extracted ADEX analysis also indicated distinct parent-child communication patterns between dyads. This study demonstrates the importance of evaluating EBP in community settings and how new technologies, such as LENA, can support this objective.

8 **136.008** An Automated Telehealth System for Long-Term Monitoring of Meltdowns in Children with Autism Spectrum Disorder: Epxautism.

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Background: Â For patients with autism spectrum disorder, wait times often exceed three months for scheduling specialty clinic visits. Moreover, current attempts to ascertain data on longitudinal behavior patterns in autistic patients during this interim rely primarily on retrospective interviews or questionnaires, which suffer greatly from recall bias. The lack of accurate and effective monitoring of clinically relevant behaviors such as meltdowns can lead to less than optimal care provided to the patient. We have created an automated text-message-based intervention to bridge these temporal gaps in care, giving providers data and automatically triaged alerts on patients' behaviors between visits.
Objectives: Â To monitor patients with autism through a novel telemedicine system which facilitates early detection of exacerbation of problem behaviors, providing a tool for healthcare providers to improve treatment recommendations and medication titration.
Methods: Â EpxAutism sends daily/weekly messages to parents of children with autism asking about quantity and duration of meltdowns, instances of aggression/disruption/self-injurious behavior during meltdowns, and whether there is a known antecedent to meltdowns. The system synthesizes data received through text responses for each patient, triages patients into one of three risk categories based on their change in behaviors, and sends alerts to providers upon recognizing significant upward deviations in recorded problem behaviors.
Results: We achieved an 85% overall response rate to messages through an initial phase of pilot study involving 6 enrolled patients. Each patient has a diagnosis of autism spectrum disorder. Duration of enrollment spans from 18 days to 110 days. Response rate has not decreased significantly for patients enrolled for more than 100 days.
Conclusions: We present EpxAutism, a novel, cost-effective monitoring system for behaviors of children with autism between clinic visits. Prompt reporting both reduces recall bias as compared to paper surveys/retrospective questionnaires and allows providers in this study to remotely alter subjects' plan of care. Data suggest that our intervention is a promising method of tracking meltdowns and problem behavior in patients with autism, allowing physicians to more precisely treat patients and also be alerted more promptly about ongoing behavioral problems. Results from our pilot warrant further study in a larger population, which is ongoing.

9 **136.009** Distance Mentoring Model for Autism Assessments in the Indian Himalayas

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Background:
Reductions in under five mortality rates has shifted global program and policy focus to lives that thrive and live with or without disability in most parts of the world. In the Indian Himalayas, identification and assessment of developmental disabilities in young children poses a huge challenge, and intervention therefore remains a far dream. With no developmental pediatricians in Uttarakhand, the Himalayan state of India, the program uses expertise from a qualified early development expert based in a high income country to train, support and supervise a team of local professionals in the field of Autism, for assessment and intervention.
Objectives: The model provides expert supervision and support in the local language and maximizes use of limited resources of time, money and personnel. The model depends on a strong mentorship capacity, committed time by professionals to assess, record, share and seek guidance, and deep relationship building which in turn strengthens the support between the family and the team.
Methods:
The program began with on site training on the use of new tools for autism diagnosis (ADOS and ADIR). The module initiated with training to build the knowledge base and was followed by multiple hands-on sessions on the use of assessment tools with families whose children were suspected to have autism. Multiple sessions with close supportive supervision were followed by the local professional teams conducted the assessments independently. The assessments reports were emailed to the consultant and video recordings were uploaded on the Internet using strict privacy settings. The local team received immediate feedback and timely support with diagnoses and intervention plans for the child and the family. Technical assistance also involved access to web resources, and training for parent groups. The consultant and the local team meet face to face twice a year to develop further insights, review complex cases, facilitate parent meetings, and training in advanced modules.
Results:
In six months, the team assessed, diagnosed and provided intervention support to fifty children with autism. The model did not need funding and provided on-site training support using new assessment tools and distance support to validate assessments and diagnoses thereafter to a team of local professionals for children with autism. Children and families receive the benefit of best practice interventions and specialist inputs that would otherwise not be available for them. While we understand the pivotal role technology plays in this program, we cannot undermine the value of on-site visits and face-to-face meetings.
Conclusions:
Though the technology is not complex, for local professionals to learn and use the video camera, email, whatsapp and youtube are innovations in their own right. This model can be adapted and applied to settings where there is a need for training and support. The distance-mentoring model can supplement the more traditional model of site based service delivery and support. The foundation is aiming to scale the model for children with cerebral palsy and Down syndrome.

10 **136.010** Data Collection and Token Management System for Group-Based Therapy

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Background: Motivity is a cloud-based software system for data collection and therapy management that is being developed with grants from the National Institute of Mental Health. Motivity is unique in its ability to support group-based therapy with multiple observers using mobile devices to collect data simultaneously on large groups of individuals, providing real-time data visualization to all users, updating instantly when new data is collected. The Motivity prototype was tested at the University of Washington Apex Summer Camp for 5 weeks. Apex is an evidence-based program serving over 90 children each summer that utilizes a naturalistic day camp environment and structured recreational activities to teach behavioral and social skills. Therapy is conducted by 40 trained interventionists. Over 25 different behaviors are tracked continuously throughout the day to monitor progress and develop individualized goals. The program includes a reward system in which children earn points for appropriate behavior, such as helping peers and staying on task, and lose points for behaviors targeted for decrease, such as interruption and teasing.Â At the end of each day, children redeem points for prizes.
Objectives: Â The Motivity prototype was deployed to Apex with the goal of evaluating the real-time feedback capabilities and scalability of the system to support large group therapy and school-based interventions.
Methods: Prior to deployment of Motivity, Apex data collection was entirely paper-based and was extremely tedious and time-consuming for Apex staff, involving over 150 hours per week of staff labor to tally up points and enter data for analysis and point tracking.Â For the field test, the paper system was completely replaced by the Motivity prototype on iPads and Kindle Fire devices.Â The camp director (BA) used Motivity's Knowledge Authoring Interface (KAS) to model the Apex scoring system and measures in Motivity. To support groups, a Group Teach interface was added to Motivity in the form of a scrollable grid, with each column representing one child. Staff were trained for 1 hour on the use of Motivity prior to camp. Children were divided into 8 groups of 12 children each; each group had 4-5 staff members facilitating group therapy with 2-3 mobile devices (iPads and Kindle Fires) per group.
Results: The Motivity model and navigational structure fully supported the Apex behavior tracking and token economy requirements. After five weeks of use, **over 150,000 behaviors were recorded**. Apex staff reported high satisfaction with the system, including usability, performance, and functionality.
Conclusions: The camp director reported that Motivity saved each staff member over 4 hours of manual labor per week, and allowed much quicker evaluation of student progress, clinical responsiveness, and ability to provide comprehensive information to parents. For example, counselors were able to monitor behavioral changes in response to a medical adjustment and share definitive data with the family and primary care providers immediately. Motivity allowed interventionists to provide a level of clinical support that would not have been possible using the original paper methods.

11 **136.011** Healthier Me: An App to Promote Health, Nutrition and Safety for Children with ASD

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Background:
Behavioral and cognitive challenges experienced by people with ASD may impact personal hygiene, nutrition, fitness, health maintenance, and safety. Neglect of personal and oral hygiene, nutrition, and exercise may lead to infection, tooth decay and periodontal disease, obesity, hypertension, coronary disease, and other adverse health conditions. Indeed, the CDC reports that obesity is 50% more common among teens with developmental disabilities including ASD. In addition, behavioral and cognitive challenges associated with ASD may impact safety practices, leading to unintentional injury of self or others or loss of life. The Interactive Autism Network notes that approximately half of children with ASD over the age of four attempt to elope from a safe environment. More than one third of children with autism who wander or elope have significant challenges communicating their name, address, or phone number. This represents a significant public health concern among youth with ASD.
Objectives:
Aim 1: Develop technology to track, educate, and reinforce behaviors which promote health, good hygiene, nutrition, and safety forÂ youth with ASD
*Aim 2:*Examine experiences of users of the technology developed in Aim 1.
Methods:
Interviews were conducted with families, service providers, and other professionals in the field of ASD to determine needs, approach, and content to address daily hygiene, healthy eating, fitness, and safety concerns. Based on this primary input, a mobile app, “Healthier Me”, was developed, tied to delivery of personalized reinforcers with ability to track related behaviors and provide user-directed education. Healthier MeÂ was developedÂ to track hygiene habits; reinforce healthy food choices, drinking sufficient water, and avoidance of foods specified as allergic; track activities and time spent being physically active; and offer information about eachÂ “healthier” activity. Specific educational information related to safety and health maintenance is also provided on the app. People with ASD and/or their caregivers were recruited to download the app. Qualitative interviews were then conducted regarding the user experience.
Results:
Data derived from qualitative interviews will be reviewed in an iterative manner to develop common themes related to engagement and utility of the app.
Conclusions:
The creation of the “Healthier Me” app is an innovative approach to meeting an unmet need – helping youth with autism learn and practice safe and healthy activities as a regular part of their lives. It can be used in multiple environments by the person with ASD and/or their various care providers to encourage good health, nutrition, fitness, and safety. User experience will provide pilot information regarding initial response to the app among stakeholders. Subsequent research will focus on both short-term and long-term effects of the use of the “Healthier Me” app on health status, personal hygiene, and safe behaviors of youth with ASD.

12 **136.012** Can Computer-Assisted Training of Prerequisite Motor Skills Help Enable Communication in People with Autism?

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Background: Our and others' research indicates that in fully a third of people with autism who lack communicative speech, the communication deficit may actually be a deficit in motor skills necessary to move the mouth and the vocal tract. These individuals have difficulties in fine, gross and especially oral motor skills, and a disparity between impaired expressive language and relatively intact receptive language. Within this motor-impaired subgroup specifically, training in visuomotor skills prerequisite to effective communication may provide a 'back door' to developing social communication, via a route other than speech.
Objectives: Given the labour-intensive nature of communication therapy in general, we therefore are interested in testing a computer-assisted, caregiver-mediated training programme for motor communicative skills, and contrasting learning effects between a motor-impaired autistic subgroup defined by impaired fine and especially oral motor skills and disparity between impaired expressive and more intact receptive language.
Methods: Point OutWords (http://www.AutismCollaborative.org/PointOutWords/), free, tablet-based software designed and tested in collaboration with autistic clients and their communication therapists in India and England, and deployed worldwide, exploits the autistic fascination with parts and details to motivate attention to learning manual motor and oral motor skills essential for communication. Autistic clients practise pointing and dragging objects, then pointing at sequences of letters on a keyboard, and if and when able, speaking the syllables represented by these letters. Users and their parents or guardians can opt into network-based collection of data on motor interactions with Point OutWords, from which are derived several internal measures of baseline and change in visuomotor targeting error, touch force, and any anticipatory movements of the device by the caregiver. These measures of motor skills development internal to the software are complemented by external, standardised tests of motor and communicative development administered to children (Mullen Scales of Early Learning: Fine Motor, Receptive Language, Expressive Language) and parents (Movement Assessment Battery for Children (MABC-2) Checklist), Social Responsiveness Scale (SRS-2), Parenting Stress Index (PSI-4), Vineland Adaptive Behavior Scales II); these are analysed by a 2x2 (motor-impaired or motor-intact subgroup, Point OutWords treatment or iPad exposure control condition) repeated-measures analysis of variance, and also by Bayes factors as data are accumulated.
Results: Â Pilot results indicate an increase in pointing and dragging accuracy in all internal measures $p < 0.05$). Current results show no significant effect of treatment or of subgroup; Bayes factors indicate neither conclusive evidence for or against any effects. Data acquisition continues, and updated results will be presented.
Conclusions: Â Caregiver-mediated, computer-assisted therapies targeting prerequisite motor skills – and the Point OutWords therapy in particular – may or may not be an effective complement to traditional therapies that more directly address autistic social communicative deficits. Further exploration is warranted and is being implemented. Point OutWords is at least a useful demonstrator of the potential for a task-sharing approach to autism therapy that involves caregivers and avoids the need for additional clinical staff time.

13 **136.013** Matrix Training on a Mobile Application to Enhance Language Learning and Generalization in Minimally-Verbal Autism

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Background: A “delay in, or total lack of, the development of spoken language” characterizes minimally-verbal individuals with autism. Many learn to communicate through alternative means such as tablets and mobile technology. However, utterances on these devices are often very limited; learners do not surpass single-word responses for requesting and labeling, and vocabulary repertoires are small. Matrix training is a language intervention to systematically build up vocabulary and teach longer word combinations to produce more complex utterances. In this generative approach to instruction, words are arranged in a matrix format so that some multiword phrases are taught and others develop without direct instruction. Specifically, linguistic elements (e.g., nouns, verbs, etc.) are presented in systematic combination matrices, which are arranged to induce generalized rule-like behavior, a particular difficulty in autism.
Objectives: A mobile application, SPEAKmore!, was developed to carry out matrix training on a tablet device (see Figure 1). This study aimed to answer:

1. Does language training with SPEAKmore! facilitate production of action-object combinations on a tablet device? This was accomplished by measuring the percentage of correct target forms in intervention probes.
2. Do newly learned skills generalize to untrained action-object combinations. This was achieved by taking generalization probes during the intervention phase assessing performance on combinations that were never taught before.

Methods: An experimental single subject design, that is a multiple probe design (Horner & Baer, 1978), was used across sets of action-object combinations with generalization probes of untrained combinations. This design is currently implemented with five participants, who are between 8-12 years old, have an official diagnosis of severe autism according to CARS-2 and ADOS-2 scores, qualify as minimally verbal by having no more than 10 spoken words, and communicate primarily on a tablet. These students were taught action-object combinations on a 6x6 matrix with SPEAKmore!. From the total pool of 36 possible symbol combinations, the researcher created four different sets of three symbol combinations each that were actively taught. The remaining 24 combinations were tested for generalization effects.
Results: Preliminary results are available for two of the five participants. Figure 2 shows participants’ performance measured as the percentage of correct symbol combinations. Both participants demonstrate a similar pattern of successful acquisition of symbol combinations during the intervention condition and subsequent generalization to untrained stimuli. Within three intervention sessions, both participants reached over 80% correct and their performance remained at this level. Performance on generalization increased steadily for both over the course of intervention. Effect sizes as measured by the Non-overlap of all Pairs Index indicate a medium-strong effect for participant 1 and a strong effect for participant 2.
Conclusions: Results suggest that matrix training through a mobile application may be a promising approach to teach new vocabulary and enhance the complexity of utterances for tablet communicators with severe autism. To further investigate the robustness of this technology intervention, findings need to be replicated using (a) different language targets (e.g., agent-action, adjective-object combinations), and (b) expansions from two-term to three-term semantic relations (e.g., agent-action-object).

14 **136.014** Integrating User Analytics into Mobile Applications for Speech and Language Treatment in Autism

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Background: Today it is common for Internet-based businesses to collect data regarding customer behavior and exploiting such behavior to expand their business. However, more introspectively such companies also seek to use these data to understand their effectiveness in serving their customers. In fact, the translation of research efforts in autism technology almost demands these same types of user analytics as rationale for those who would invest in and seek to promote the commercial enterprises that are essential for the translation of such research into practice. Specifically, translation necessitates the confluence of at least 4 key elements i) a societal recognition of a problem, ii) a common understanding of the economics involved in addressing the problem, iii) proof that delivery of a solution to the problem is accepted in the marketplace, and iv) protectable intellectual property that allows an enterprise to recover the costs of translating the research into practice in the market.
Objectives: The objectives are to address the double bottom line problem: how to translate research into practice in a manner that is economically feasible and that simultaneously provides societal benefit. The former activity is addressed by assessing the societal value of delivering more effective mobile technology solutions to the autism population, while the latter focuses on measuring the degree to which this activity has the potential for impact.
Methods: Â Autism tools created for today’s popular tablet architectures (e.g. iOS, Android) can be fitted with common usage analytics collection tools (e.g., Google Analytics) as a first order usage information collection mechanism. We will illustrate this scenario using an application for augmentative and alternative communication (AAC) training in minimally-verbal autism: The SPEAKall!® application has been instrumented with Google analytics to measure communication activities performed by the population using SPEAKall!. This instrumentation allows the collection of usage patterns from a large population of AAC users, which is distinct from the assessment of individual effectiveness in and immediately after therapy delivery sessions. While collecting such usage patterns does not suffice as evidence for the effectiveness of a therapeutic approach, it does demonstrate the market acceptance and employment of an approach in practice, and is a completely objective measure of mobile technology usage intensity.
Results: Preliminary results indicate the SPEAKall! application was downloaded by 9,223 users over a 6-months period; 12,810 therapy sessions took place with an average length of 11min. A bi-modal weekly therapy pattern emerged. Most users composed 2-word utterances, more than half proceeded to 5-word sentences. Google Analytics also revealed most frequently used interface features and motor patterns for accessing app content. Further data analyses will examine vocabulary growth by studying the degree to which users create new symbol vocabulary. Finally, we will also present a study of geographical user spread.
Conclusions: App analytics technology can be a meaningful way to assess and justify implementation of mobile technologies in autism treatment. It generates an additional strand of evidence for technology solutions beyond traditional efficacy data from behavioral or neurophysiological investigations.

15 **136.015** My Hospital Story - a Hospital Narrative App

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Background: Â *My Hospital Story*is a mobile web app designed to prepare children and their families for medical visits and procedures at Boston Children's Hospital (BCH). Hospital narratives use images of children and developmentally appropriate text to prepare children and families for medical experiences. Hospitals in particular can cause stress for families and children with autism due to sensory concerns, communication challenges, and the unpredictability of the environment. Fears about these stressors and the hospital environment can often lead to medical needs not being met.
Objectives: Â The *My Hospital Story*app is a digital version of hospital narratives designed to improve the patient and family experience by preparing and supporting children and families when they come into the hospital. The goals of the app include lowering patient and parent anxiety about the hospital setting, increasing patient coping with visits and procedures through prior preparation, and removing barriers to care.
Methods: Â Before their visit to the hospital, children and caregivers can use the app to view step-by-step photos of their upcoming clinic visit, surgery, or procedure. Each photo is accompanied by text illustrating what is happening from the child's perspective as well as the hospital environment. The app allows users to enter their child's name and gender so that pictures and text are personalized.
Results: Â At this time we have 13 stories available on the app spanning 6 departments (Developmental Medicine, Psychiatry, Neurology, Surgery, Audiology, and Phlebotomy) in our hospital. Currently, the app is being used in a pilot study to help prepare families for audiology visits.
Conclusions: Â This project has been a collaborative effort between the Autism Spectrum Center, Child Life Services, and the Innovation and Digital Health Accelerator at Boston Children's Hospital. The mobile app has several advantages over paper versions. It is accessible at all times, it is easily edited and updated, and lastly it provides an attractive interface to share and communicate these hospital narratives to children. Future versions hope to include additional features, such as automated audio readings of the text, translation into multiple languages, and the ability to customize stories with personal photos.

16 **136.016** A Usability Evaluation of a Driver Training Application for Teens with Autism Spectrum Disorder

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Background: Â Learner and licensed drivers with autism spectrum disorder (ASD) make more driving errors than their peers without ASD. Yet there is a lack of driver training tools specifically designed for the learning preferences of individuals with ASD.
Objectives: Â The objective is to design a driving training tool that incorporates learning preferences for individuals with ASD while adhering to usability principles (e.g., ease of learning and user satisfaction).
Methods: Â A usability evaluation was conducted with four rounds of subjects, alternating between neuro-typical teens and teens with ASD. Each round of subjects tested the Drive Focus™ application (app) prototype. Subjects' comments about the app were collected using a "think aloud" method while observations of their interaction with the app were recorded. A human factors psychologist and an occupational therapist reviewed the comments and observations and decided whether to and how to resolve problems based on usability principles and four learning preference themes. Next, the app was refined and the entire process was repeated again until four rounds of subjects had tested the App.
Results: The number of comments/observations decreased within groups; subjects without ASD 245 (n=5) to 225 (n=8) while subjects with ASD: 125 (n=6) to 32 (n=5). The number of changes made to the app in support of learning preferences included themes of concrete language (55 changes), structure and predictability (41changes), visual information (21 changes), and generalization (8 changes).
Conclusions: The total number of changes declined between the initial and final session for each of the participant groups (subjects without ASD and subjects with ASD) suggesting that the iterative process of the usability evaluation was helpful in improving the app. The decline in comments and observations was most notable among the ASD groups suggesting that the application of learning preference themes was particularly useful.

17 **136.017** Jemime, a Serious Game to Teach Emotional Facial Expressiveness for Individuals with Autism Spectrum Disorders.

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Background: Poor social cognition is a core problem in Autism Spectrum Disorders (ASD). Individuals with ASD have difficulties in emotional processing (recognition and analysis of social situations) as well as in emotional production, with a reduced emotional facial expressiveness. Some remediation programs using the support of new technologies have been developed to train people with ASD to produce emotions. However, none of them are based on a production of social situations with imitative models as avatars.
Objectives: The objective of the JEMImE project is to develop a specific game, in which people with ASD are first trained to imitate emotional expressions displayed by an avatar and then taught to produce emotional facial expressions in social scenes.
Methods: Players with ASD are asked to produce emotional expressions (facial and vocal) of joy, anger or sadness. Two technical innovations have been introduced. Firstly, the software performs a real-time analysis of the emotional production of the players. Secondly, an automatic evaluation is performed by anÂ innovative algorithm implemented in the software, comparing the players' productions with those of typically developing children (6-12 years) contained in an inbuilt emotional expression database.
Results: Â The game is composed of two phases, both using the technical innovations (real-time automatic detection and automatic evaluation). The first phase aims toteach players how to produce joy, anger or sadness using games based on 1) imitation and 2) production on request, within or without social situations (Fig 1). Thus, the software is able to detect each emotion produced in real-time, and to give a feedback to the player about the quality of the emotion. The second phase, using a 3D virtual environment, aims to train spontaneous emotional productions, depending on the social context. Indeed, the progression through the social scenes presented to the player depends on the quality of the emotional productions performed by the player, and changes if the production is not relevant for the current scene. In this phase, the software detects each produced emotion and gives a feedback about the accuracy of the emotional expression according to the context.
Conclusions: In summary, JEMImE software offers a personalized training for the production of emotional expressions in patients with ASD. Future research should investigate the efficiency of the algorithm for the training of the production of emotions in players with ASD. The JEMImE game is expected to benefit ASD individuals, their families and care-givers by offering them an easily accessible and amusing tool to train emotional expressiveness.

18 **136.018** Rethink: Leveraging Technologyto Disseminate Evidence-Based Interventions

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Background: Â There are dozens of established, effective interventions for individuals with Autism Spectrum DisorderÂ (ASD) (Wong et al, 2015) However these evidence-based practices are difficult to implement in community based settings such as schools (Stahmer et al, 2015; Suhreinrich, 2013). Access to effective intervention is even more difficult for children of poverty and for those in rural settings (Elder, Brasher & Alexander, 2016). Public educators require significant training and time to learn to deliver evidence-based practices (Stahmer et al, 2015). There are more than 400,000 FTE paraprofessionals engaged in the education of special education students (U.S. Department of Education, 2010). The vast majority of special education paraprofessionals, 97%, report providing one-to-one instruction to students with disabilities (Carter, O'Rourke, Sisco, & Pelsue, 2009). Unfortunately, many paraprofessionals do not receive adequate training to meet the high demands of this profession (However, Ghere and York-Barr (2007).Â Video modeling has been determined to be an effective method to support educators in learning to implement evidence-based practices (Catania & Reed, 2009; Moore & Fisher, 2007).
Objectives: Does access to Rethink's video models of evidence-based practices increase the ability of paraprofessional educators improve instructional practices and their ability to deliver evidence-based instruction to students with ASD?
Methods: Â A pre-post survey was conducted for content knowledge and application of the evidence-based practices for the paraprofessionals. Social validity wasÂ assessed regarding the utilization of the video models for adult learning with paraprofessionals. Supporting classroom teachers completed a pre-post measure regarding paraprofessional performance in the classroom and also participated in a social validity assessment.
Results: Â Paraprofessionals participating in the project demonstrated increased knowledge of evidence-based practices on the post assessment. Social validity measures reported that the practices were effective in changing instructional behavior in the classroom and that the method of professional development was acceptable for adult learners. Supporting classroom teachers reported that paraprofessionals were more effective in their delivery of instruction and that the utilization of the short video models is an effective method of providing professional development to paraprofessionals.
Conclusions: It is imperative that evidence-based practices move out of the research institutions and into the applied setting of schools and classrooms. Paraprofessionals deliver instruction to learners with ASD, yet they do not receive adequate training. A cost-effective, efficient method of training paraprofessionals may include the use of on-demand video-models. This study demonstrates how one commercially available technology product can be utilized to improve instruction delivered by paraprofessionals in public school classrooms.

19 **136.019** Autism Focused Intervention Resources and Materials (AFIRM): Supporting Teachers Use of Ebps

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Background:
There is a national need for preparing teachers and other educational staff to implement evidence-based practices (EBP) with students with ASD. A report from the National Professional Development Center on Autism Spectrum Disorder (NPDC) details 27 evidence-based practices, supported by research, that are effective for individuals with ASD (Wong et al., 2014). However, selecting and implementing EBP for individuals with ASD poses challenges for practitioners in special education and related fields. The US Department of Education recently funded a new, e-learning resource, AFIRM (http://afirm.fpg.unc.edu/), for 2 years. AFIRM is developing online, self-paced learning modules on these 27 practices for teachers of students with ASD. To assess the effectiveness of AFIRM, users complete surveys on the usefulness, relevance, and quality of the online modules.
Objectives:

1. Describe the usage data (page views, session length) from the AFIRM site.
2. Examine the usability, relevance, and quality of AFIRM modules through collected survey data.
3. Examine how teachers and practitioners are using the AFIRM resources in practice

Methods:
Google analytics will be used to describe usage data of the AFIRM site. Following completion of a module, users have the option to complete a survey addressing the usability, relevance, and quality of the modules with Likert-type questions on a four point scale with 4 being the highest possible rating. In fall 2016, a survey of 9000+ AFIRM users will be completed. The results will identify how these practitioners are actually using the resources and materials in their classrooms. Descriptive statistics will be used to address the second and third objective.
Results:
Collection of data is ongoing as the number of modules expands and more users complete modules. Currently, the AFIRM website has over 15,500 registered users. The AFIRM site has had more than 1,170,000 page views with average session duration approximately 13 minutes. Users rated the quality of the modules highly with a mean of 3.5 (n=12,329). Users found the modules relevant to their work (m = 3.54, n=12,329) and useful (m=3.5, n=12,329). Based on a pilot survey of AFIRM users, AFIRM users (n=50) found the step-by-step guides, implementation checklists, tip sheets for professionals, and data sheets to be the most useful resources available on the site. Eighty-eight percent of respondents (n=33) visit the AFIRM site at least once a month. Nine-seven percent of respondents (n=33) found the AFIRM modules moderately helpful or very helpful in improving use of evidence-based practices. Data collected through March 2016 will be used to describe findings.
Conclusions:
Initial findings indicate that teachers, practitioners, and professionals who complete the AFIRM modules find them relevant to their work, useful, and the quality of the modules high. AFIRM users find the AFIRM supplemental materials and resources useful. Most AFIRM users return to the site on a monthly basis and feel the modules and resources are helpful in improving use of evidence-based practices.

20 **136.020** Autism Navigator®: Using Implementation Science to Improve Global Access to Early Detection and Intervention for ASD

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Background: Global prevalence estimates of autism spectrum disorder (ASD), ranging from 0.6%-1.5%, have raised awareness of ASD worldwide (Elsabbagh et al., 2012; Schendel et al., 2012). Research has documented the effectiveness of early intervention, which underscores the need for efficient, effective tools to support healthcare providers in detecting red flags by 18-24 months. There is a research-to-practice gap in high-resource countries that widens in low-resource countries. Implementation science offers a framework and systematic strategies to facilitate the process of adopting evidence-based practice and sustaining with fidelity in everyday settings that can be utilized to reduce the time between scientific advances and widespread implementation. Mobile technology offers one potential solution to bridging the research-to-practice gap. Autism Navigator®(AN) is a collection of web-based courses and tools with video illustrations that offers the potential for access globally. AN has used an implementation science framework to promote coordinated change for community uptake and sustained utilization in medical, social service, and early intervention systems.
Objectives: This technology demonstration will showcase AN's web-based collection of courses and tools and report on the process of development, deployment, and utilization of the courses.Â
Methods: AN was developed by the FSU Autism Institute. AN for Primary Care is an online course using interactive slides and illustrative video clips of toddlers with ASD. After completing the course, providers can use the online automated Smart ESAC (*Early Screening for Autism and Communication*) screening tool within an E-Co-System with provider and family portals linking to 5 resources on the FIRST WORDS Project website. The 16-by-16 Lookbooks and Social Communication Growth Charts are for all families. Families of children with a positive autism screen are invited to About Autism in Toddlers, ASD Video Glossary and the How-To Guide for Families. Input from advisory boards and focus groups involving stakeholders informed the development of the E-Co-System. The E-Co-System was built through an iterative process of feedback, review of material for cultural appropriateness, and revolving enhancements to the portal.
Results: We will describe the launch of AN over the past two years beginning with Florida and Georgia and then expanding to other states in the US and other countries including Canada, South Africa, and Brazil. We launched our first free course, About Autism in Toddlers in April 2015 and had 3,643 unique users enrolled from 21 countries in the first 12 months, which increased incrementally to 6,557 unique users from 103 countries after the next 6 months. Autism Navigator for Primary Care has 612 unique users enrolled from 7 countries. The How-to Guide for Families is being piloted with 85 users in 3 countries. Tablet computers will available to experience the screening tool and web-based resources.
Conclusions: Innovative models to increase the number of culturally and ethnically diverse professionals who can deliver evidence-based services are vital to improving global competence in early detection and intervention for ASD (Khan et al., 2012). AN provides a cost-efficient platform, using mobile technology to combine an automated screening tool, parent and provider portals, and links to web-based resources.

21 **136.021** Introducing a Novel Community-Based Assessment Tool: The Computerized Social Affective Language Task (C-SALT)

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Background: Social communication is a significant area of weakness for individuals with developmental differences like autism spectrum disorder (ASD), but is notoriously expensive and time-consuming to measure. A recent movement toward fine-grained behavioral imaging using cutting-edge technologies could drastically improve our ability to automatically capture subtle and complex social communication impairments, thus laying the groundwork to generate personalized interventions. To this end, we developed a self-contained, scalable 5-minute computer program to elicit vocalizations from individuals aged 6+ (C-SALT; Computerized Social Affective Language Task). Programmed in Unity3D, this cross-platform tool incorporates established research paradigms (e.g., a social narrative task, phonetic measures) into an engaging screen-based interface. Our ultimate goal is to generate clinically meaningful language profiles that can be compared to national norms, for the purposes of: (1) improving screening and diagnosis of social impairment in remote areas, (2) informing treatment planning (clarifying areas of strength and weakness), and (3) revolutionizing how we measure intervention efficacy. To accomplish these goals, we have begun to partner with colleagues and community organizations to deploy C-SALT in summer camps, schools, and via internet. Here, we describe our pilot efforts to collect data from child and adolescent participants with ASD, other psychiatric or psychological conditions, and typical controls.
Objectives: Assess the feasibility of using C-SALT, a low-cost computer program that children can operate independently, to gather vocalization data as part of a community-based social communication and motor battery.
Methods: C-SALT was administered to 67 children (mean age=10.6 years, 77% male) enrolled in summer camps for children with disabilities, or general YMCA programs. Thirty-seven participants had ASD according to parent report, 18 were typically developing controls, and 12 had non-ASD clinical diagnoses or first-degree relatives with ASD. C-SALT was the last task in a 20-minute mobile battery.
Results: Despite being the final task in the battery, C-SALT data was successfully collected from 80% of participants. Of the participants that did not complete C-SALT, 65% had autism and 50% had parent-reported speech-language impairments (mean age: 11.29 years). In response to this finding, we developed C-SALT-PL, containing paradigms modified to suit the needs of pre-literate or minimally verbal participants. Using largely automated methods (e.g., time stamps built into C-SALT output for each child), we have begun segmenting and analyzing facial expressions, gestures, and audio data collected via C-SALT. Although these analyses are preliminary, we expect that participant vocalizations will diverge in two primary areas that affect social communication: acoustic properties of voice (pitch variation, volume control, shimmer and jitter), and word choice (word frequency, lexical diversity, social/nonsocial focus). Our measure of sustained phonation, in particular, holds promise as a language-agnostic measure of vocal-motor control.
Conclusions: This project capitalizes on a natural synergy between computational linguistics and developmental psychopathology to precisely quantify real-world social communication difficulties in children with ASD. We will have C-SALT and C-SALT-PL available and prepared to demonstrate at IMFAR 2017, along with pilot data demonstrating the ability of these measures to distinguish diagnostic groups and quantify social communicative ability with high precision.

22 **136.022** "Tots Guide - Track and Act", an Online Early Developmental Screening Tool for Parents

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Background: Â Early identification of developmental disorders is critical for the well-being of children and their families. It is the responsibilityÂ of primary care professionals to improve developmental outcomes through early surveillance and appropriate referral of children with developmental delays. However, factors such as limited consultation time in busy office practice, inappropriate methods of screening, high threshold for referral and negligence of parent's concern diminish the effectiveness of early surveillance. Therefore, it is important to develop a tool that is systematic, easy, and convenient for primary care practitioners to improve the effectiveness of developmental surveillance and referral patterns.
Objectives: Â To develop and test the accuracy of a web-based developmental screening toolÂ "Tots guide – Track and Act" for long-term monitoring of milestones in young children.
Methods: Â In a pilot study, 80 children (4–30 months of age) visiting our centre and fulfilling the inclusion criteria were enrolled. The inclusion criteria were children between the ages of 4 months to 30 months presenting with concerns in their development, and born at term gestation with no antenatal or post-natal complications. The exclusion criteria were children born at pre-term gestation, and those with physical deformities/syndromes. Parents were informed about the online screening tool "Track and Act" in www.totsguide.com at the initial meeting. The scores were automatically sent to the center's mail account when parents completed the online screening. The online screening tool assessed 4 domains of development – language and communication, movement and physical, cognitive, and socio-emotional, through a series of "Yes/No" questions corresponding to the age of the child [Score: 61–100 (normal development), 41–60 (developmental concern/borderline delay), <40 (developmental delay)]. The children also underwent a formal developmental assessment using the Developmental Assessment Scales for Indian Infants (DASII) that consisted of 230 items to test the motor and mental development in children less than 30 months [Score: >85 (normal development), 70–85 (developmental concern/borderline delay), <70 (developmental delay)]. The results obtained from this screening were compared with those of DASII in these 80 children.
Results: Â According to our analysis, the online screening tool scoring showed similar results to DASII scoring in 74% of children (59/80) in the mental domains, and in 85% children (68/80) in the motor domain, which indicates significant comparability.
Conclusions: Â Based on our pilot results, we can conclude that the online screening tool may be a reliable initial screening tool that parents can use for preliminary assessment of developmental milestones in their children. In cases of lower and borderline scores, parents can consult their pediatrician for further required and recommended assessments and interventions. This is an ongoing study and we are continuously recruiting more eligible subjects to this study to increase the sample size to conduct domain-specific statistical analyses. The online screening tool is also available in three regional Indian languages to facilitate usage by non-English speakers, and is being developed as an App. We hope that this tool will help in increasing the early detection and diagnosis of developmental disorders such as autism spectrum disorder, leading to timely intervention.

23 **136.023** Integration of Knowledge Extracted from Clinical Notes with Patient Reported Outcomes and Genetic Reports for Advancing Research into Phelan Mcdermid Syndrome

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Background: Phelan McDermid Syndrome (PMS) is a rare genetic disease (~1100 diagnoses worldwide) primarily diagnosed in children caused by loss of function of the SHANK3 gene, which is also implicated in Autism. Diagnosis is only Seapossible with genetic testing and often delayed. Knowledge extracted from clinical notes and Patient Reported Outcomes (PRO), two underused sources of detailed information about patient conditions, could significantly augment our understanding of PMS.
Objectives: The objective of this work is to demonstrate the integration of: a) knowledge extracted from patient clinical notes with b) PRO data sourced from the PMS International Registry (PMSIR) and c) the content of curated genetic reports, on the PCORI PMS Data Network (PMS_DN).
Methods: Manual curation of clinical notes deleted pages with unusable content such as illegible text, images, ECG readouts, and cursive handwriting. Forms and surveys with checkboxes and formatted questions that could lead to false positive errors in the knowledge extraction process were also removed. The Tesseract optical character recognition tool extracted raw text content from the curated notes. Then, the MITRE MIST scrubber and the Scrubber toolkit (in the Apache cTAKES natural language processing engine) erased Protected Health Information. Apache cTAKES extracted knowledge by identifying occurrences of concepts defined in the Unified Medical Language System and mapping these concepts to concept definitions in 20 clinical terminologies including ICD-9/10, MeSH, SNOMED, and the Human Phenotype Ontology. Knowledge extracted from clinical notes can be verified by experts with a novel validation tool that allows them to crosscheck the identified concepts against the raw text. PRO data from the PMSIR, comprising answers to developmental, clinical, and adult behavior questions were preprocessed for statistical analysis. Extract-Transform-Load pipelines loaded the knowledge extracted from clinical notes and the PRO data along with curated genetic reports of the PMS patients into the i2b2-tranSMART clinical data repository.
Results: PMS Foundation (PMSF), a nonprofit organization advocating for PMS research, obtained informed consent to participate in PMSIR from 981 families (461 in USA). Of these, 557 families (300 in USA) consented to share their data, including PRO, genetic reports, and clinical notes, with Harvard Medical School. Manual curation of clinical notes of 114 patients (with 47938 pages), sourced from healthcare providers by a 3rd party vendor, removed 7618 unusable pages. Apache cTAKES extracted the knowledge content of the remaining 40320 pages. This knowledge was loaded into PMS_DN alongwith preprocessed PRO data from 344 patients and curated genetic information from 121 patients. Authorized autism investigators can browse and interrogate the aggregates of this integrated patient data on the PMS_DN Web portal (https://pmsdn.hms.harvard.edu). Investigators with the appropriate IRB clearances can obtain advanced, raw data download privileges on PMS_DN from PMSF.
Conclusions: PMS_DN facilitates research into PMS by providing authorized investigators access to high-quality knowledge extracted from clinical notes, PRO data, and genetic reports, enabling novel insights into the origin, progression, and treatment of this disorder. This exemplifies the potential of collaborations between academic researchers and family organizations such as PMSF to drive clinical research.

24 **136.024** Automated Measurement of Head Movement Coordination in Infant-Parent Dyads and Later ASD Outcomes

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Background:
The Face-to-Face/Still-face (FFSF) is an early index of social-emotional functioning, which assesses infant and parent abilities to coordinate emotion and arousal states. Early atypicalities during social interactions, such as unusual head movements, may contribute to the social impairments that characterize children with autism spectrum disorder (ASD). Symptoms of ASD may alter the coordination of head movements between infant and parent during interactions, disrupting successful communication and social interactions. The quantity and speed of head movement—pitch (nods), yaw (turns), and roll (lateral inclinations)—between infants and parents may be more or less coordinated over early interactions in ASD.Â Compared to human coding, automated measurement can objectively quantify movement behaviors in infants with and without ASD risk.Â Our group recently found that older children with and without ASD systematically differ in their head movements in response to social stimuli.
Objectives:
Examine whether coordination of the quantity of infant and parent head movement in the FFSF differs by ASD risk and outcome.
Methods:
Infant-parent dyads (N=64) completed the FFSF at 6 months. Dyads included infants with (high-risk) and without (low-risk) an older sibling with ASD. Three degrees of rigid head movement—pitch, yaw, roll— were tracked from the video-recordings using an automated, computer-vision approach (Zface; Jeni, Cohn, & Kanade, 2015). Head angles were quantified as angular displacement and angular velocity. Root mean square values were calculated to measure the magnitude of angular displacement (*quantity*) and angular velocity (*speed*) of head movement. At 36 months, infants were assessed for ASD by a clinician, informed by the Autism Diagnostic Observation Schedule. We assessed differences in head movement coordination between infants and parents in low-risk children (Low-Risk/No-ASD, *n*=22), high-risk children without ASD (High-Risk/No-ASD, *n*=31), and high-risk children with ASD (High-Risk/ASD, *n*=10). Analyses were within-group, zero-order correlations of the total quantity of infant and parent displacement and velocity of head movement in the FFSF. R-to-Z transformations were used to compare correlations between groups.
Results:
Infant-parent correlations of angular displacement tended to be greater for the High-Risk/ASD group than the High-Risk/No-ASD (*p*s<.09) and the Low-Risk/ASD groups (*p*s<.09) for pitch, yaw, and roll. Infant-parent correlations of angular velocity were greater for the High-Risk/ASD group than the High-Risk/No-ASD group for pitch and roll (*p*s<.01) and tended to be greater for yaw (*p*=.09). Infant-parent correlations of angular velocity were greater for the High-Risk/ASD group than the Low-Risk/ASD group (*p*s<.05; **Table 1, Figure 1**).
Conclusions:
Here, automated measures of early interaction revealed that infants later diagnosed with ASD had the highest levels of coordination with their parents in the quantity and speed of head movement. For angular displacement and angular velocity, High-Risk/ASD infants and parents exhibited the highest associationsÂ of head movements. Low-Risk/No-ASD infants and parents exhibited the lowestÂ associationsÂ of head movements.Â High-Risk/No-ASD infants and parentsÂ typically exhibitedÂ associationsÂ of head movements between the other two groups. While it is unlikely that infantsÂ matchÂ their parents' head movements, parents of High-Risk/ASD infants may match thoseÂ ofÂ their infants more vigilantly than parents of infants in other groups (Beebe, 2011).

25 **136.025** Application of Semi-Automated Video Scene Coding for Reducing Manual ROI Marking in Eye-Tracking-Based ASD Studies

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Background: Defining dynamic regions of interest (ROIs) is an essential component in eye-tracking-based studies of autism that use dynamic videos. In dynamic videos, the content and ROIs change moment-by-moment. In order to track high level constructs such as moving faces, or people, it is necessary to adjust ROIs in a time-dependent manner. This labor intensive and time consuming task is usually done manually.
Objectives: To generate a semi-automated approach capable of identifying and marking any type of ROI in any video sequence automatically and with minimal human operator involvement.
Methods: The proposed mechanism for ROI tracking utilizes Speed Up Robust Features, a scale and rotation invariant object detector/descriptor method. 1)the algorithm detects ROIs new locations/orientations in the frame and defines new ROIs (objects not captured by ROIs) 2)the operator review the results and re-evaluates weakly detected ROIs using new manually markups. Nine video files, used for an activity monitoring eye tracking paradigm in toddlers with ASD (Shic et al., 2013), that contained 9 to 16 ROIs are considered. These videos included two people (P1 & P2) surrounded with multiple objects conducting a controlled activity. The ROIs included 1) dynamic: head(H),body(B), upper/lower-face(UF&LF) regions and 2) static: images on the wall(I) and toys on the ground(T) in the scene.
Results:
The ROIs that are identified with potentially faulty detections and the percentage of frames that their faulty detections occurred in are presented in following table. It should be noted that the results represent the first pass of the algorithm only while additional runs with corrected base ROI can help to re-detect/re-track the ROIs in question for frames with potentially faulty detections. Moreover, although the below ROIs are automatically marked as less successfully detected, a closer investigation indicated that a fair percentage of the potentially faulty detections are likely to be acceptable without any need for re-tracking.
It is noteworthy that majority of inaccurately tracked/detected ROIs are located within facial regions. This is likely due to 1) smaller size of these regions which makes the task of finding robust representative features more difficult and 2) the differences between the viewing angle and orientation of the head in the first frame (the basis of the ROI detection) and the later frames in the video. Data from Thirty-six 4-8 year-olds, ASD n = 14 (11 males,MDQ=88.36,SD=19.84) and non-ASD n=22 (13 males, MDQ=108.91,SD=12.38) shows that there are similarities between eye tracking result variables computed through ROIs developed through this semi-automated process and standard ROI specification techniques.
Conclusions: We have designed a computational method for ROI tracking which dramatically lowers the time burden of defining ROIs for complex, dynamic videos. This approach, which does not lead to identical ROIs as manual coding, nonetheless shows similar performance on certain measures of outcome. Further work will aim to expand the scope and flexibility of our region tracker and to explore the use of this technique on fully unconstrained video inputs, such as that acquired from head mounted eye trackers in natural interactions.

26 **136.026** Topological Data Analysis Reveals Meaningful Subgroups in ASD Research Data Based on Neural Responsivity and Behavioral Measures

T. McAllister[1]*, A. Naples*[2]*, S. A. A. Chang*[3]*, S. Hasselmo*[4]*, M. J. Rolison*[1]*, J. A. Trapani*[1]*, S. M. Malak*[1]*, K. A. McNaughton*[1]*, T. C. Day*[1]*, T. A. Halligan*[4]*, B. Lewis*[5]*, E. Jarzabek*[1]*, K. Ellison*[1]*, K. Stinson*[6]*, J. Wolf*[7] *and J. McPartland*[1]*, (1)Child Study Center, Yale School of Medicine, New Haven, CT, (2)Yale Child Study Center, Yale University School of Medicine, New Haven, CT, (3)Yale University, New Haven, CT, (4)Child Study Center, Yale University, New Haven, CT, (5)Yale School of Medicine, Darien, CT, (6)Yale University- Child Study Center, Milford, CT, (7)Yale Child Study Center, New Haven, CT*

Background:
Modern neuroscience research increasingly collects vast quantities of rich, multivariable data, but analytical methods remain largely unchanged. Without more sophisticated tools, much of the data will not be fully utilized. While clinical and electroencephalography (EEG) datasets from Autism Spectrum Disorder (ASD) research routinely contain hundreds of variables, standard statistical practices incorporate relatively few. Topological Data Analysis (TDA) is an approach designed to explore high-dimensional datasets. The Mapper algorithm (Singh, Mémoli and Carlsson, 2007) reduces dimensionality while maintaining structural features by generating clusters in the full high-dimensional space. Resulting cluster visualizations offer insights that can direct statistical investigation, support current methods, and foster understanding of complex interrelations between variables.
Objectives:
By implementing the Mapper algorithm, we: (1) visualize both EEG and clinical characterization data from a sample of individuals with ASD and typically developing controls (TD); (2) identify and describe subgroup clusters; (3) assess the utility of TDA for high-dimensional clinical neuroscience datasets.
Methods:
The Mapper algorithm was implemented using Javascript and Python, and used to analyze data from individuals with ASD and TD controls (ASD:n=61,mean age=14.08;TD:n=40,mean age=13.96). Results were visualized as 2D force-directed graphs in which cluster shading indicated the percentage of individuals in a group with a diagnosis of ASD. Clinical variables included measures from the Child Behavior Checklist, Social Responsivenss Scale, and Vineland Adaptive Behavior Scales II. Event Related Potential (ERP) variables included amplitude and latency at the P100 and N170 in response to dynamic faces. Naive clustering grouped subjects based on similarity in a high-dimensional space, then edges connected clusters with shared subjects.
Results:
We created visualizations for behavioral data, ERP data, and combinations of both. Resulting structures identified areas of diagnostic similarity suggesting that high-dimensional clustering can successfully differentiate groups in a data-driven manner. Groups containing both individuals with and without ASD suggest there are differentiable clusters that further parse heterogeneity within diagnostic categories. Figure 1 demonstrates a strong differentiation of diagnosis between cluster groups, based on 76 variables of only ERP data. Two regions outline groups of similar subjects with 100% and 27.27% of subjects diagnosed with ASD, respectively. 79% (n=73) of the eligible population (n=94) fit into these groups, with 2 subjects found in both.
Conclusions:
Our initial results indicated subgroups of participants that are diagnostically well-differentiated by high-dimensional neural data, and other subgroups which appear more heterogeneous. Ongoing work seeks to analyze which ERP measures discriminate most between subgroups, and thus improve predictive models of differences in clinical phenotype. Further work will examine using subgroups for stratifying samples in clinical trials, and whether smaller subgroups within diagnoses differ meaningfully. These visualizations of latent structure within our data are a novel and valuable tool for exploring clinical datasets and building unique insights that inspire further research. Our findings have already identified meaningful subgroups based solely on ERP data. TDA warrants further development and refinement, particularly in clustering methodology. This method will allow us to scale up to richer multi-modal datasets e.g. including clinical characterization and eye-tracking measures.

27 **136.027** Design of an Interactive Pretending System for Young Children with ASC

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Background: A subcategory of play, pretend play is generally considered a fundamental stage for child development and education. However, pretend play is one of the most affected areas of development in Autism Spectrum Conditions (ASC). Yet, traditional interventions for supporting its development are extremely rare, and the effectiveness of interventions that do exist is reported to be moderate, at best. Recent work, however, has provided promising evidence for the potential of news forms of digital technology to facilitate pretend play in children with ASC. Yet, research is relatively limited in being able to inform the design of technology to promote pretend play in children with autism in real-world contexts (e.g. classroom).
Objectives: Building on previous work and inspired by current practice, the long-term aim of this research is to investigate how a technology-based application can support the process of pretend play in young children with ASC.
As a first step towards reaching that aim, the studies reported here: a) investigate current practice and procedures used by teachers and practitioners to help children with pretending; and b) explore a set of possible concepts and technologies that might be relevant to promoting pretend play in children with autism.
Methods: A focus group study with 13 education professionals (10 Speech and Language Therapists and 3 teachers) has been conducted. The study followed a semi-structured group discussion driven by a predefined set of topics: a) interventions/activities used; b) choice and use of objects; c) choice of prompts and prompt-fading strategies; and d) the use of structure.
This was followed by a design workshop with 4 education professionals using an adaptation of the Inspiration Cards Workshop technique.
The empirical data has been analysed using both deductive and inductive thematic analysis.
Results: Preliminary results have revealed that education professionals regard pretend play as an important element for learning in children with autism. However, due to the limited amount of resources (e.g. trained staff, time) and the higher priorities for building other abilities (e.g. language, joint attention) pretend play is either not targeted or used as a context for developing other skills. Also, most participants do not follow a particular model/intervention for promoting pretend play, but adopt various general guidelines, not specific to a particular model/intervention.
Scenarios of technology use have been identified along with a set of technology characteristics considered useful in practicing and supporting pretending with children with autism, such as: dynamicity, simplicity, personalisation, and flexibility
Conclusions: Early data suggests there is a lack of support for promoting pretending in ASC in real-world contexts. Such outcomes reinforce the motivation behind this research.
Based on these results and relevant literature, next steps will involve a series of low- and high-level prototyping sessions with education professionals that will shape the implementation of an interactive system for practicing and developing pretend play in children with autism.

28 **136.028** Engagement of Children with ASD Using a Tactile Robot

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Background: Individuals with autism spectrum disorder (ASD) have widely recognized challenges in social communication. Social robots have been designed and used to provide an alternative and perhaps easier way to promote engagement and communicative exchange in children with ASD.Â Here, we characterize the behavioral effects of children and adolescents with ASD using a tactile robot, not explicitly designed to promote engagement or communication. CARBO (short for CARetaker RObot) was built by incorporating a spiking judgment neural network robot "brain" (Chou, et al., 2015) that has the potential to learn from interactions. The robot's shell is covered with trackballs creating a smooth surface for tactile interaction.Â Two games (ColorMe and FollowMe) request hand movements in a particular pattern on the shell to illuminate LEDs beneath each trackball.Â Eight directions of the trackball are mapped to different colors of the underlying LEDs.Â The games are designed engage participants in producing a wide range of movements, as well as turn-taking activities that paint CARBO's shell.
Objectives: Through a series of structured play sessions with CARBO and another interactive toy serving as a comparison, we aimed to objectively characterize behaviors during interactions.Â The results of these interactions will be used to improve the games and to create a version of CARBO that can serve as a bridge in behavioral therapy for children with ASD.
Methods: We recorded multiple sessions of children and adolescents interacting with a tactile robot to test if interactions with CARBO modified sensory and motor behaviors and/or engagement and communicative behaviors in individuals with ASD. Using the data from CARBO, we assessed changes in movement behavior during game play. Using video data, we employed a dictionary of behaviors (including gestures and utterances) that we created for video-based coding and compared behaviors observed while each participant interacted with CARBO and another interactive toy.Â We also examined how behaviors changed over multiple visits. All coding was conducted using the multimodal annotation tool ELAN.
Results: We characterized interactions in 6 children and adolescents with ASD.Â These individuals spanned the continuum from non-verbal to very facile with verbal communication, and ages 9-17. Participants exhibited longer duration engaged interactions with CARBO than with other toys. We also noticed fewer instances of repetitive behaviors while participants were engaging with CARBO. Responses to CARBO's requests to change movement direction or speed were responded to promptly in most cases.
Conclusions: Â Our pilot study observations suggest that children are considerably more engaged with the tactile robot, CARBO than with an interactive game. The extended duration of the engagement and ability to use the robot in requesting and turn-taking behaviors make it a useful tool in behavioral therapy.

29 **136.029** Robots Teaching Autistic Children to Mind Read: A Feasibility Study of Child-Robot Interaction during Emotion-Recognition Training

*A. M. Alcorn[1], T. Tavassoli[1], S. Babović Dimitrijevic[2], S. Petrović[2], S. Skendzic[2], V. Petrović[2] and **E. Pellicano**[3], (1)UCL Institute of Education, University College London, Centre for Research in Autism and Education (CRAE), London, United Kingdom, (2)Serbian Society of Autism, Belgrade, Serbia, (3)Centre for Research in Autism and Education (CRAE), UCL Institute of Education, University College London, London, United Kingdom*

Background: Autistic children often have difficulty recognising emotions and facial expressions relative to typically developing children. Several existing projects have shown promise in using robot-assisted interventions for social and academic skills teaching with autistic children, including emotion recognition. Robots can be more predictable and less complex than interaction with humans, and may be more "comfortable" for autistic children. Little is known, however, about the levels of language, cognitive skill, or sensory tolerance that are necessary or desirable for robot-assisted interventions to be implemented effectively for autistic children.
Objectives: This project tested the feasibility of an emotion-recognition training programme in developing the potential of robot-assisted interventions for autistic children in Serbia and in the UK.
Methods: Forty-two autistic children, aged between 5 and 12 years, have been assessed thus far (testing is ongoing): 23 children (3 girls) in the robot-assisted training condition and 19 children (3 girls) in the researcher-only comparison condition. The majority of children have additional intellectual disabilities and limited spoken communication. In both conditions and over a number of sessions, we implemented steps 1-4 of the emotion training programme, "Teaching Children with Autism to Mind Read" (Howlin, Baron-Cohen, & Hadwin, 1999), which is designed to teach recognition of photographic and schematic faces, and identifying emotions in stories. Critically, in the robot-assisted condition, a Robokind R25 humanoid robot ("Zeno") with realistic facial expressions helped to deliver the programme (controlled covertly by the adult). All sessions were recorded by audio, video, and depth sensors (Kinect).
Results: In each condition, children took between 3 and 8 sessions to complete the training steps, or reach a ceiling: 28 children completed all steps, 6 were unable to complete any steps, and 8 reached an intermediate step. Two of the 23 children were unable to engage in the robot-assisted condition due to sensory sensitivity. Overall, task scores and researchers' qualitative reports suggest that participating children gained knowledge of emotions, and interacted successfully and positively with the robot. Some more able participants found the current tasks and robot overly simple, and were better engaged when asked to take on a 'teaching' role toward him (e.g., ask robot to give an answer after child responded). Analysis is ongoing.
Conclusions: A humanoid robot can be a feasible, meaningful, and engaging tool in an emotion-recognition teaching programme for autistic children with limited spoken communication. Indeed, more children successfully engaged with the robot and the tasks than was initially predicted by researchers and parents. Robot-assisted intervention may be particularly valuable for those children who may not easily access other interventions due to their language or ability. This study was the first phase of data collection for this large-scale project, with further feasibility studies running in Serbia and the UK. The resulting data will form part of a large "benchmark" annotated dataset of behaviour, gestures, and speech of autistic children, which will be made available to the wider research community. Future analyses will also compare the effectiveness of robot- and researcher-assisted training on teaching emotional and social skills.

30 **136.030** Triadic Human-Robot Conversation for Easier Disclosing: A Case Study Involving Individuals with Autism Spectrum Disorder

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Background: Individuals with autism spectrum disorder (ASD) often find it difficult to disclose their concerns to their caregivers (e.g., clinical psychotherapists, special education teachers, etc.). Previous research indicates that robots might be an easy conversation partner for individuals with ASD (Shimaya et al, 2016). An important next step is investigating how disclosing to robots can be bridged to disclosing to their caregivers. Triadic conversation including a robot, an individual with ASD, and his/her caregiver is expected to provide the bridge. However, the presence of the caregiver might decrease the advantage of easy conversation provided by robots.
Objectives: We examine whether individuals with ASD disclose their thoughts or concerns in the triadic conversation involving the robot and their teacher. We also examine whether the teacher can discuss the disclosed contents with them face to face after the triadic conversation.
Methods: Three individuals (two are male) with ASD participated in triadic conversations with a female teacher and a small desktop humanoid robot "CommU". Their ages ranged from 23 to 25. One of them had a relatively low IQ (< 40) and the other two had a relatively high IQ (> 70). The participants were chosen because their teachers had difficulty in understanding their thoughts or concerns. The robot was tele-operated by the first author. Its utterance was produced by using a keyboard interface, and its gaze, which indicated who it was talking to, was controlled by a GUI. The teacher was forbidden from speaking except when replying to the robot. A participant-specific undisclosed and interesting topic list (UDI-list), consisting of topics that the teacher was interested in but unaware of, was prepared. The conversation was conducted mainly between the robot and the participant, and the robot asked the participant questions about the topics in the UDI-list, whereas the robot-teacher conversation on the same topic was sometimes inserted.
Results: The average conversation time for the participants was 20.7 min (SD = 4.7). Approximately 86% and 14% of the conversation time was spent on the robot-participant conversation and robot-teacher conversation, respectively. No participant stopped the conversation until the robot suggested that he/she finish it. All of them disclosed at least one of their thoughts or concerns to the robot in the presence of the teacher, to whom they had never disclosed on the topics. Examples of disclosed contents were his/her anxiety about job-hunting, and their hobbies, etc. The teacher conducted additional conversation with one participant and could discuss the disclosed contents with her face to face.
Conclusions: It is important that the individuals with ASD disclosed their thoughts or concerns even though the teacher was included in the conversation. The result implies triadic human-robot conversation might be effective in getting individuals with ASD to disclose easily before their caregiver, which involves their chances of disclosing indirectly to their caregiver. Increasing the number and the period of the sample, as well as developing an easier interface for the robot tele-operation to manage triadic conversation are important issues worth considering in the future.

Panel Session
137 - Understanding Barriers That Families from Racial/Ethnic Minority Groups in the United States Face in Obtaining an Autism Spectrum Disorder Diagnosis and Services for Their Children
10:30 AM - 12:00 PM - Yerba Buena 3-6

Panel Chair: Amber Angell, *Occupational Therapy, University of Illinois at Chicago, Chicago, IL*

Discussant: Sandy Magana, *Disability and Human Development, University of Illinois at Chicago, Chicago, IL*

Children in the United States from racial/ethnic minority groups and low-income families experience persistent disparities in autism spectrum disorder (ASD) diagnosis and services. Compared to middle class White children, they are more likely to experience delays in diagnosis, less likely to be diagnosed at all, and are less likely to receive timely, high quality healthcare services. Research has made clear the existence of these disparities, but little is understood about their causes. Using diverse methodologies, this panel presents research on barriers that parents from racial/ethnic minority groups, and/or low income parents, face in obtaining an ASD diagnosis and services for their children in the United States. Barriers include both parent and provider factors, including parent knowledge about and experience with ASD; implicit provider biases in primary care screening/referrals; and parent access to information about safe and effective ASD treatments. These findings have implications for reducing disparities through targeted parent and provider education programs.

10:30 **137.001** Autism Spectrum Disorder Knowledge and Experience Among Low-Income Parents Attending WIC

K. Zuckerman[1], *A. E. Chavez*[2], *C. Regalado*[1], *O. J. Lindly*[3] *and J. A. Reeder*[4], *(1)Division of General Pediatrics, Oregon Health & Science University, Portland, OR, (2)Oregon Health & Science University, Portland, OR, (3)College of Public Health and Human Sciences, School of Social and Behavioral Health Sciences, Oregon State University, Corvallis, OR, (4)Oregon WIC Program, Oregon Health Authority, Portland, OR*

Background: Â Children in racial/ethnic minority and low-income families are more likely to experience delays in autism spectrum disorder (ASD) diagnosis, and are less likely to receive an ASD diagnosis overall. Little is known about low-income and minority parent knowledge about and experience with ASD.
Objectives: To assess ASD knowledge and information in a large, ethnically diverse sample of low-income parents.
Methods: We conducted a self-administered survey on 539 parents attending their child's appointment at the Supplemental Nutrition Program for Women, Infants, and Children (WIC) in six Oregon counties, from July through October, 2015. Eligible participants had a child aged 24-59 months enrolled in WIC. Surveys were conducted in English or Spanish; bilingual oral administration was available if necessary. Survey items assessed knowledge of early signs of ASD, self-reported knowledge about ASD, and having a friend or family member with ASD. Bivariable and multivariable analyses assessed differences in outcomes for following racial/ethnic/language groups: non-Latino white [NLW], Latino-English proficient [EP], Latino-limited English proficient [LEP], and non-Latino other race English proficient [NL-O].
Results: 79% of parents approached completed the survey. Overall, parents correctly identified 64.7% of early signs of ASD. NLW and Latino-EP parents correctly identified the most early signs of ASD, even after adjustment for sociodemographic differences among racial/ethnic/language groups.Â Overall 9.9% (95% CI=7.6%-12.8%) of families had "never heard of ASD" and 35.4% (31.4%-39.6%) reported they had "heard of ASD but didn't know much about it." On bivariable analysis, Latinos with LEP (15.3% [10.9%-21.2%]) and NL-O (15.7% [8.0%-28.5%])Â were more likely to have never heard of ASD compared to NLW (1.9% [0.6%-5.9%]).Â Overall, 71.4% (67.5%-75.1%) of participants had no friends and no family members ASD. Latinos with LEP (16.2% [11.6%-22.2%]) were significantly less likely to have a friend or family member with ASD as compared to parents in the other three racial/ethnic/language groups.
Conclusions: Low-income parents, particularly Latino-LEP and NL-O parents, have relatively little knowledge and personal experience with ASD. Study findings suggest that interventions to reduce disparities in ASD diagnosis should include increasing parent awareness in low income and ethnic minority communities.

10:50 **137.002** Evidence for Implicit Bias in the Implementation of Autism Screening Tools in Primary Care

C. Nadler[1], *G. Winningham*[1], *K. J. Reid*[1], *C. Low-Kapalu*[1], *L. Pham*[2], *K. Williams*[1], *G. Rahm*[1] *and S. Nyp*[1], *(1)Children's Mercy Kansas City, Kansas City, MO, (2)Baylor College of Medicine, Houston, TX*

Background: Health disparities associated with age of ASD diagnosis have been observed for racial/ethnic minorities (Mandell et al., 2002), females (Shattuck et al., 2009) and economically disadvantaged children (Mazurek et al. 2014). While ASD screening models and tools have been discussed as possible contributors to these disparities, biased primary care screening/referral patterns have not been directly investigated.
Objectives: The objective of this study was to investigate error patterns in primary care screening and referral that may contribute to later delays in ASD diagnosis and early intervention for minority children.
Methods: A retrospective review of 18- and 24/30-month well visits (n = 4886) at an urban academic medical center yielded data on primary care provider's interpretation of the Modified Checklist for Autism in Toddlers (M-CHAT); manual re-scoring of M-CHATs allowed for the provider's interpretation to be classified as a True Positive (TP), True Negative (TN), False Positive (FP) or False Negative (FN). Demographic data and referrals for diagnostic/intervention services were also extracted from the medical record.
Results: Children in the study sample were representative of the racial/ethnic diversity of the urban area (40.1% African American, 30.6% Hispanic; 17.3% Spanish-speaking), and 80.9% of the children were publically insured. Among children determined to have a positive M-CHAT upon manual re-scoring, unweighted logistic regression analyses revealed that females (OR = 1.98. p = .004) and children of Spanish-speaking parents (OR = 2.10, p = .047) were more likely be misclassified as a negative screen by their providers, but no other demographic variables were significant predictors. When the model was propensity weighted to control for associations between demographics and the availability of an original M-CHAT to re-score, the gender bias remained significant (OR = 1.82, p = .014) but the language bias did not (OR = 1.83, p = .23). Additional biases emerged when considering any kind of misclassification (FN and FP): weighted models indicated that African American children (OR = 1.47, p = .028), speakers of languages besides English or Spanish (OR = 1.62, p = .054), and children with public insurance (OR = 1.54, p = .046) were all more likely to be misclassified. Children with correctly identified (vs. overlooked) positive screens were more likely to be referred for diagnostic/intervention services, irrespective of demographics (p < .001).
Conclusions: Patterns of primary care provider errors in interpreting autism screening tools disproportionately impacted minority and disadvantaged children in this sample, impeding access to diagnostic and early intervention services. These results strongly implicate implicit provider biases as a factor in the downstream health disparities observed for minority children who receive ASD diagnoses later than Caucasian children, and are less likely to access quality intervention services. Beyond the development of enhanced tools and screening models, unconscious and unintentional biases must be monitored and mitigated by health care professionals and researchers to adequately serve all children and families.

11:10 **137.003** The Road to Diagnosis: Perceptions, Concerns, and Experiences of Racial and Ethnic Minority Parents of Children with Autism Spectrum Disorders

W. Zeleke[1] *and T. L. Hughes*[2]*, (1)Counseling, Psychology and Special Education, Duquesne University, Pittsburgh, PA, (2)Duquesne University, Pittsburgh, PA*

Background: Parents play a major role on the path to diagnosis of their children with Autism Spectrum Disorders (ASDs). Despite the current federal and state level efforts to reduce disparities in healthcare access and utilization, racial disparities still remain. Research has shown that White children are diagnosed earlier than minority children and minority children may express ASD symptomology differently than their White counterparts. Thus, it is imperative to better understand the pathways to diagnosis for racial and ethnic minority families to ensure that their children receive the aid they need and to reduce the aforementioned racial disparities in mental healthcare service utilization.
Objectives: The purpose of this study is to explore ethnic and racial minority families' journeys to diagnosis for their child with ASD. Specifically, we aim to find out if race predicts diagnostic seeking behaviors, perceptions of the condition, and perceptions of the quality of diagnostic services the child receives.
Methods: Using data from the 2011 Survey of Pathway to Diagnosis and Services ("Pathway") (N=1725; White= 1368, Minority=347), we conducted bivariate and multivariate logistic regression to examine the difference betweenÂ minority and White children with ASD in accessing and utilizing mental healthcare services. "Pathway" is a nationally representative survey of children ages 6-17 years who were identified by the 2009/10 National Survey of Children with Special Health Care Needs (NS-CSHCN). The data set takes a close look at current and past use of clinical treatment, intervention, and healthcare services.
Results: We found a statistically significant difference on parental concern and perception of the child's condition based on race. White parents presented with more medical concerns, verbal and nonverbal communication concerns, and learning ability concerns than minority parents. No statistical difference was found related to parental concern about the behavioral, social, and sensorial difficulties of the child, parental perceptions of the child's condition, and parental perception of diagnostic services that their child received, between White and minority parents. However, the analysis yielded a significant relationship between parents' and healthcare practitioners' behavior and delay on diagnosis among minority children.
Conclusions: The result of this study indicated that healthcare providers' and parents' behavior may contribute to diagnostic delay of minority children with ASD. There is a need to develop policy, multi-culturally competent practice, and family level strategies to reduce barriers to diagnostic services for minority children with ASD.

11:30 **137.004** "It's like You've Got to Do Everything on Your Own": Latino Parents' Experiences of Traditional and Alternative Medicine for Their Children with Autism Spectrum Disorder in Los Angeles

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Background: Â Parents of children with autism spectrum disorders (ASD) have been found to rate their children's primary care physicians as "not good" at addressing autism-specific needs (Carbone et al., 2013). Latino parents report even greater challenges than White parents in accessing high-quality healthcare for their children with ASD (Magana et al, 2012). Parents may choose complementary and alternative medicine (CAM) treatments for their children with ASD when they are dissatisfied with conventional healthcare, e.g. for failing to address autism-related issues such as sleep problems or self-injurious behavior (Akins, Angkustsiri, & Hansen, 2010). While Latino parents choose CAM treatments for their children with ASD at least as often as White parents (Hall & Riccio, 2012; Levy et al, 2003), little is known about how they experience their children's healthcare services, either traditional or alternative.
Objectives: Â The purpose of this qualitative study was to understand the barriers and supports that Latino parents of children with ASD experience while seeking traditional and alternative healthcare services for their children.
Methods: Â This 12 month ethnographic study of 12 bilingual Latino families of children with ASD living in Los Angeles County was carried out in two phases. Phase 1: Two audio-recorded narrative interviews were conducted with 12 families (19 parents, 1 grandmother) about their experiences obtaining services for their children. After Phase 1, 6 families were from the original cohort were recruited using heterogeneity sampling to continue to Phase 2. Phase 2: Narrative interviews and participant observation were conducted with 6 families (11 parents) in home, clinic, school, and community contexts. Children's health records provided data triangulation. The data corpus consists of almost 80 hours of audio- and video-recorded data (40 interviews, 10 observations, 60 fieldnotes) and 333 records. NVivo 10 software was used for coding, using a narrative analytic approach (Reissman, 2005).
Results: Â All 12 families in the study utilized traditional healthcare to treat their child's illnesses, but parents did not view their pediatricians as resources for addressing their children's developmental and behavioral challenges. Parents reported feeling 'on their own' to learn about therapies and interventions. Six of the families (6 mothers, 4 fathers) utilized some form of CAM treatment for their children (e.g. diet modifications, vitamins, supplements, enzymes, Defeat Autism Now! doctors). These parents expressed frustration that their pediatricians were "hands off," contrasted with CAM practitioners who were viewed as helpful because they targeted children's development through "treatment plans," i.e. recommendations and suggestions.
Conclusions: Â The parents who chose CAM for their children with ASD viewed CAM providers as responsive, proactive, and optimistic in approaching children's developmental challenges. While pediatricians may be legitimately cautious about discussing CAM treatments with parents because many of these therapeutic modalities have been found ineffective and even harmful, the parents in the study experienced such silence as a failure to provide guidance about their children's development. These findings suggest that pediatricians can better meet families' needs by engaging with and educating parents about the safety and efficacy of a range of conventional and alternative treatments.Â

Panel Session
138 - Autism with Known Genetic Associations: Implications for 'Idiopathic' Autism
10:30 AM - 12:00 PM - Yerba Buena 7

Panel Chair: Caitlin Clements, *The Center for Autism Research/CHOP, Philadelphia, PA*

Discussant: Paul Wang, *Simons Foundation CRA, New York, NY*

Genetic syndromes associated with autism spectrum disorder (ASD) have been studied intensely in the hope of understanding the biology of these disorders and of ASD in general. These ASDs associated with mutations have become an important part of a genotype-first strategy for parsing the heterogeneity of ASD, illuminating the pathophysiology, and defining targets for pharmacological treatment. Prime examples include research on Fragile X and copy number variants such as 16p11.2 and 22q11.2. However, it remains unknown how well treatments based on these genetically defined forms of ASD will generalize to 'idiopathic' ASD. This uncertainty stems from the genomic heterogeneity of ASD and from the phenotypic heterogeneity within each syndrome. This panel examines four examples of this genotype-first strategy: Fragile X, 22q11.2 copy number variants, and disruptions in SCN2A and DYRK1A. Discussion will focus on phenotypic heterogeneity, implications for translational research, and the challenges to assessing clinical outcomes. Presentations will include an analysis of familial phenotypes (DYRK1A), identification of a critical region for ASD risk in 22q11.2, genotype-phenotype correlations observed in SCN2A mutations, and differences in language and social communication trajectories between idiopathic ASD and Fragile X syndrome.

10:30 **138.001** Opposing Effects on NaV1.2 Function Underlie Differences Between SCN2A Variants Observed in Individuals with Autism Spectrum Disorder or Infantile Seizures

R. Ben-Shalom[1], C. M. Keeshen[1], K. N. Berrios[1], J. Y. An[1], K. J. Bender[2] and ***S. J. Sanders****[2], (1)UCSF School of Medicine, San Francisco, CA, (2)UCSF, San Francisco, CA*

Background: Exome sequencing has revealed that *SCN2A* is one of the most frequently mutated genes in autism spectrum disorder (ASD). Variants in this gene are also important risk factors for developmental delay and infantile seizures. While the missense *SCN2A* variants observed in infantile seizures predominantly lead to gain of function in the neuronal sodium channel $Na_V1.2$ that it encodes, the effect of the missense variants observed in ASD on $Na_V1.2$ remains unknown.
Objectives: 1) To perform a literature search of *SCN2A* mutations and to assess genotype-phenotype correlations. 2) To characterize the missense mutations observed in ASD electro-physiologically.
Methods: To assess the allelic spectrum of *SCN2A* mutations, genotypes and phenotypes were collated from all papers with *SCN2A* in their title or abstract and all large exome studies (>50 cases) in neuropsychiatric disorders. Electrophysiological assessment was performed for all missense variants observed in the Simons Simplex Collection or Autism Sequencing Consortium using voltage-clamp recordings from HEK293 cells.
Results: The literature review revealed 117 unique *SCN2A* variants in 148 families. The 118 families with sufficient phenotypic data clustered in four phenotypic groups: 20 variants in families with benign infantile familial seizures (BIFS); 8 variants in individuals with infantile seizures and mild developmental delay; 51 variants in individuals with epileptic encephalopathy (EE) characterized by infantile seizures and moderate to severe developmental delay; and 39 variants in individuals with a developmental disorder characterized by ASD and/or intellectual disability. Of note, loss of function variants were only observed in this last category. Electrophysiology analysis shows that all loss of function variants completely prevent sodium conductance, as do five of the eight missense variants in ASD. The remaining three missense variants altered channel function in three different ways, all of which reduced neuronal excitability in pyramidal cell simulations to the same degree of loss of function variants. In contrast, variants associated with infantile seizures increased neuronal excitability.
Conclusions: While *SCN2A* variants in infantile seizures lead to gain of function in $Na_V1.2$, ASD variants lead to loss of function. Numerous genetic loci associated with neuropsychiatric disorders are observed across a range of diagnoses including developmental delay, ASD, and schizophrenia. Here, we show that functional analysis of apparently similar *SCN2A* missense mutations can distinguish two neuropsychiatric phenotypes: infantile seizures and ASD/developmental delay. This observation suggests that distinct neurobiological processes relating to specific neuropsychiatric disorders may be characterized through the investigation of single gene mutations, the first such example to our knowledge.
These data allow us to revise our estimate of the contribution of *SCN2A* mutations to ASD risk. We observe *SCN2A* mutations in 0.29% of ASD cases, a figure marginally higher than that for *CHD8* (0.24%), making *SCN2A* the gene with the strongest evidence for ASD-association based on exome analysis and second only to Fragile X Syndrome as a single gene cause of ASD.
Examination of the neurobiology consequent to *SCN2A* haploinsufficiency, alongside parallel analysis of genes related to chromatin regulation, synaptic structure, and Fragile X Syndrome, is likely to provide critical insights into the etiology of ASD.

10:50 **138.002** Increased Risk of Autism Among Individuals with Atypical 22q11.2 Deletions or Duplication Involving COMT and RANBP1

C. C. Clements[1], *T. L. Wenger*[2], *J. Miller*[3], *A. B. de Marchena*[4], *A. Zoltowski*[1], *L. M. DePolo*[5], *D. M. McDonald-McGinn*[6], *E. H. Zackai*[7], *B. Emanuel*[7] *and R. T. Schultz*[3],

(1)The Center for Autism Research/CHOP, Philadelphia, PA, (2)Pediatrics, Craniofacial Center, Seattle, WA, (3)The Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (4)Center for Autism Research, Philadelphia, PA, (5)Department of Pediatrics, Children's Hospital of Philadelphia, Philadelphia, PA, (6)The Children's Hospital of Philadelphia, Philadelphia, PA, (7)The Children's Hospital of Philadelphia, Philadelphia, PA

Background: Increased rates of Autism Spectrum Disorder (ASD) have been observed in individuals with copy number variations (CNVs) of the 22q11.2 region, including both deletions (Fine et al, 2005) and duplications (Wenger et al, 2016a).Â However, research has not yet identified which of the 30-40 genes in this region confer autism risk. One research strategy entails narrowing the search space to smaller regions by studying nested (termed "atypical") CNVs within the full 22q11.2 region. The 22q11.2 region includes four low-copy repeats (LCRs); CNVs usually span LCR-A to LCR-D while smaller, nested CNVs (e.g., LCR-A to B, LCR-A to C) affect fewer patients. We have hypothesized that the region between LCR-A and LCR-B might be particularly important for ASD (Wenger et al, 2016b). This region contains a gene, *RANBP1*, involved in the metabatropic mGluR network, with important roles in neuronal excitation. mGluR signaling has been implicated in autism via syndromic ASD (Fragile X and tuberous sclerosis) and non-syndromic ASD (Hadley et al, 2014).
Objectives: To compare autism risk associated with 22q11.2 in individuals with and without involvement of the LCR-A to LCR-B region.
Methods: Thirty-six individuals with atypical duplications (n=9) or deletions (n=27) of 22q11.2 were recruited from a genetic specialty clinical at the Children's Hospital of Philadelphia. Participants included 13 individuals with affected LCR-A to B regions (LCR-A to B n=10, and LCR-A to C n=3) and 23 without (LCR-B to D n=17, and LCR-C to D n=6). Autism diagnoses were ascertained via review of the participants' electronic health record and additional medical or psychoeducational records provided by participants. Proportions were analyzed with a chi-square test. Parents of a subset of participants completed measures of social communication and psychiatric symptoms (SRS n=16, SRS-2 n=5, SCQ n=17, and CASI-4R n=22). Comparisons will be made to existing data from typically developing controls (t=73), individuals with idiopathic ASD (n=70), and individuals with typical deletions (n=62) and duplications (n=28) of 22q11.2.
Results: A significantly higher rate of ASD diagnoses (38.4%, 5/13) was observed for those individuals with a CNV involving the LCR-A to B region compared to those without involvement of LCR-A to B (8.7% rate, 2/23) $\chi^2(1,N=36)=4.70$, p=0.03. LCR-A to B involvement occurred only in individuals with deletions. In analysis restricted to deletions, rates remained similar (38.4% and 7.1%) and the result remained marginally significant $\chi^2(1, N=27)=3.83$, p=0.050. Record review results were supported by preliminary parent symptom report results. We observed higher mean scores in individuals with involvement of LCR-A to B on the SCQ (mean=16.0(9.4), range=5,30) and SRS (mean t-score=80.8(12.7), range=64,96) compared to individuals without involvement of the region (SCQ: mean=11.3(8.3), range=1,24; SRS: mean t-score=72.9(19.2), range=39,100). However, *nota bene*, group differences on continuous measures were not statistically significant, perhaps because of insufficient sample size; data collection is ongoing.
Conclusions: Among individuals with atypical CNVs in the 22q11.2 region, we identified a smaller region implicated in many but not all cases of ASD. LCR-A to B involves COMT and RANBP1, which may warrant further investigation for association with ASD.

11:10 **138.003** Phenotypic Presentation and the Role of Parental Phenotype in Accounting for Variability in Individuals with Disruptive DYRK1A Mutations

R. K. Earl[1], *C. M. Hudac*[2], *J. Gerdts*[3] *and R. Bernier*[3], *(1)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (2)Psychiatry & Behavioral Sciences, University of Washington, Seattle, WA, (3)University of Washington Autism Center, Seattle, WA*

Background: Dual-specificity tyrosine phosphorylation-regulated kinase 1A, or *DYRK1A*, is a gene recurrently disrupted in 0.1-0.5% of the ASD population (Iossifov et al., 2014; O'Roak, Vives, Fu, et al., 2012). Individuals with disruptions to *DYRK1A* present with similar features, including microcephalic head size, intellectual disability, speech delay, ASD, and facial dysmorphisms (Bronicki et al., 2015; Ji et al., 2015; van Bon, Coe, & deVries, 2015). In previously published cases assessed for ASD, incidence of ASD remains variable, suggesting variable expressivity for the gene (Bronicki et al., 2015; Van Bon et al., 2015). Additional dimensional characterization of ASD symptoms and co-occurring impairments in individuals with mutations to *DYRK1A* is needed to understand the observed clinical variability. Phenotyping efforts have yet to situate individuals with *DYRK1A*in the context of larger familial genetic background, which may provide important information regarding genetic impact across domains of functioning and variability between carriers.
Objectives: Objectives are 1) to summarize categorical and dimensional phenotypic features of known cases of *DYRK1A* mutations; 2) to compare incidence of features to those in a large sample of individuals ascertained for ASD and a cohort of individuals with other disruptive genetic events associated with ASD, such as *CHD8;* 3) to situate phenotypic variability in cases of *DYRK1A*in the context of their non-carrier parents' phenotype, thus accounting for familial background and "expected" outcome in the absence of the mutation.
Methods: Participants of this study include 61 individuals with *de novo DYRK1A* mutation (i.e. probands), including previously published cases and participants of The Investigation of Genetic Exome Research (TIGER) study at the University of Washington. A subset of 10 probands and their non-carrier parents who received standardized assessments of IQ, social behavior (Social Responsiveness Scale), motor skills (Purdue Pegboard Test), and physical measurements (e.g. head circumference, height, weight) will be used to calculate effect sizes between probands and their parents. Comparison samples include two large cohorts of participants with ASD: the Simons Simplex Collection and the Genetic Linkage Study of Autism. Additional comparisons will be made with subjects from the TIGER study with ASD-associated *CHD8*mutations. Nonparametric analyses will be used to compare categorically-measured phenotypic features and univariate ANOVA will be used for continuous phenotypic variables.
Results: Preliminary findings from analysis of 29 *DYRK1A* probands reveal high rates of Intellectual Disability (100%), language delays (100%), microcephaly (90%), feeding difficulties (89%), and ASD (60%) (see Table 1). Data collection is ongoing with further analyses identifying parent-proband effect sizes for a cohort of individuals with *DYRK1A* mutations and their parents (n = 10) and comparing effect sizes to cohorts with ASD and those with *CHD8*mutations.
Conclusions: Recurring features emerge across individuals with mutations to *DYRK1A*. Specifically, a majority of individuals with *DYRK1A* exhibit intellectual disability, speech delays, motor impairments, microcephaly, seizures, ASD, and feeding difficulties as has been reported in smaller cohorts in previous literature. Analyses of parent-proband effect sizes will provide an estimation of *DYRK1A*'s impact on cognitive, behavioral, and physiological domains, and will inform the variability in phenotype observed across individuals.

11:30 **138.004** Understanding the Comorbidity of Autism Spectrum Disorder and Fragile X Syndrome: Moving Beyond a Categorical Approach

L. Abbeduto[1]*, A. J. Thurman*[2] *and A. McDuffie*[3]*, (1)M.I.N.D. Institute, UC Davis, Sacramento, CA, (2)Psychiatry, M.I.N.D. Institute, UC Davis, Sacramento, CA, (3)UC Davis, Sacramento, CA*

Background: Fragile X syndrome (FXS), the leading inherited form of intellectual disability, results from a mutation in the *FMR1* gene on the X chromosome, which leads to a reduction in the associated protein (FMRP). Autism spectrum disorder (ASD) is a common comorbid condition in FXS. The prevalence of ASD in FXS has been estimated at >50%, with FXS accounting for 3-6% of ASD cases. It has been assumed that ASD symptoms reflect the same underlying psychological and neurobiological impairments in FXS and idiopathic ASD and, therefore, drugs showing benefit for FXS will also be beneficial for idiopathic ASD.
Objectives: In contrast, we have previously presented data documenting important differences between individuals with comorbid FXS and ASD and those with idiopathic ASD in terms of ASD symptoms, behavioral and psychiatric correlates, and developmental trajectories. In this presentation, we will discuss three new studies, each involving a different cohort, designed to further clarify the comorbidity of FXS and ASD. The studies entail comparisons of FXS and idiopathic ASD in terms of profiles of language impairments and predictors of impairment (Study 1), analysis of predictors of variation in the developmental trajectories of social-communication impairments within FXS (Study 2), and analysis of predictors of variation in ASD symptoms within FXS (Study 3).
Methods: In Study 1, we examined scores on measures of structural language (i.e., receptive and expressive vocabulary and grammar) in 4- to 10-year-old males with FXS (*n* = 51) or idiopathic ASD (*n*= 36), as well as the predictors of those scores, which included age, IQ, and ASD symptom severity. In Study 2, we examined predictors of within-syndrome variation in the developmental trajectory of social-communication using an experimental measure of the skills involved in correcting communicative misunderstandings. Participants in Study 2 were males with FXS (*n* = 36), ages 10-16 years and followed longitudinally. In Study 3, we examined the prediction of social-affective and restricted and repetitive behavior symptom severity (measured by the ADOS) from a variety of factors, including language ability, nonverbal cognitive ability, and FMRP. Males with FXS (*n* = 58), ages 15-23 years, participated in Study 3.
Results: In Study 1, we found a different profile of language impairments and different predictors of language impairment in FXS and idiopathic ASD, even when the FXS sample was limited to those with an ASD diagnosis. In Study 2, we found that individual differences in this measure of social-communication were related to differences in nonverbal cognitive ability and FMRP, but not to ASD symptoms (contrary to expectations for idiopathic ASD). In Study 3, we found that language ability and nonverbal cognitive ability predicted social-affective and restricted and repetitive behavior symptom severity, respectively, which is unlike the pattern reported for idiopathic ASD.
Conclusions: These studies reinforce the notion that there are clinically and mechanistically important differences between FXS and idiopathic ASD that are masked by the categorical diagnosis of ASD. Thus, we argue for a symptom-based approach rather than a categorical diagnosis-based approach future research, including in studies of treatment efficacy.

Panel Session
139 - Interventions to Improve Transition Outcomes By Strengthening Environmental Supports
10:30 AM - 12:00 PM - Yerba Buena 8

Panel Chair: Julie Taylor, *Vanderbilt University Medical Center, Nashville, TN*

Discussant: Kara Hume, *University of North Carolina, Chapel HIll, Carrboro, NC*

Poor outcomes among adults with autism spectrum disorder (ASD) are well-documented and result in significant economic costs. Nearly all existing interventions focus on the adults themselves, building skills or alleviating problem behaviors. Yet, according to the International Classification of Functioning, Disability, and Health (ICF), functioning is also a product of the environments and contexts in which one finds oneself. Currently, few interventions seek to leverage supportive environments to improve outcomes for youth/adults with ASD. In this panel, we present initial findings from four interventions to improve transition outcomes by strengthening environmental supports. Presentations focus on how to improve outcomes by: (1) strengthening transition planning in schools; (2) training parents to effectively advocate for adult disability services for their son/daughter; (3) training peers to support students with ASD in post-secondary educational settings; and (4) increasing informal supports available to young adults with ASD and their families. Dr. Kara

Hume will serve as the discussant. She is Co-PI for the Center on Secondary Education for Students with ASD, the largest intervention study to date focused on supporting adolescents with ASD in the high school setting, and will focus on the unique challenges of conducting intervention research in this age group across contexts.

10:30 **139.001** A Randomized Controlled Trial of Compass for Transition Youth

L. A. Ruble[1], *M. W. Jackson*[2], *A. D. Rodgers*[1], *W. H. Wong*[1], *Y. Yu*[3] *and J. H. McGrew*[4], *(1)University of Kentucky, Lexington, KY, (2)University of Kentucky, Winchester, KY, (3)Indiana University - Purdue University Indianapolis, Indianapolis, IN, (4)Psychology, Indiana University - Purdue University Indianapolis, Indianapolis, IN*

Background: Research on transition planning and implementation indicates we are falling short for students with autism spectrum disorder (ASD). Only a quarter of parents report the transition planning process as very useful; while a third desire more involvement, and most troubling, a third report having no transition plan. Poor transition planning leads to poorer post-school outcomes, including low employment rates, limited community participation, and lack of friendships. Using an implementation science framework, we examined the effectiveness of a teacher consultation intervention as a strategy for infusing evidence based practices within transition planning and intervention for youth with ASD.
Objectives: The purpose of this presentation is to describe initial outcomes of randomized controlled trial (RCT) of the Collaborative Model for Promoting Competence and Success (COMPASS), an evidence based consultation intervention that improves educational outcomes of young children with ASD by enhancing environmental supports.
Methods: We adapted COMPASS for transition age youth using the Consolidated Framework for Implementation Science as a guide (CFIR; Damschroder, et al., 2009). To guide our adaptation we gathered information on issues of transition planning and implementation by conducting 10 focus groups with key stakeholders and asking them to describe desired outcomes, best ways to assess effectiveness, and features of good transition planning and implementation. The findings (a) described a need for information on the transition process and services that were clear and understandable, (b) informed areas of assessment for post-school goals based on understanding of student interests and strengths, (c) indicated necessity of goals for parents and teachers, in addition to students, (d) identified key players (e.g., vocational rehabilitation), and (e) suggested process changes, such as flexibility for how people are involved in meetings and individualization of assessment process based on student abilities. These themes were used to adapt COMPASS. Following adaptation, we piloted COMPASS within an RCT over two waves. Each wave occurred over a school year. Youth in their final year of school (*N*=24), their parents (*N*=24), and their teachers (*N*=24) were recruited. If teachers had more than one student with ASD, a student was randomly selected for participation. Teachers were randomized to COMPASS or a placebo control condition. Goal attainment outcomes from IEP objectives were evaluated at the end of the school year by an independent observer unaware of group assignment.
Results: Results from our first wave of participants (*N* = 7; Age_m = 18.5 years) revealed higher goal attainment change scores for students whose teachers received COMPASS (*M* = 3.2) compared to the control (*M* = 0.75). The second wave of data are currently being collected. In addition to final results, we will elaborate on the themes identified by the focus groups, how we adapted COMPASS based on the themes, and final results.
Conclusions: The limited post-school outcomes of young adults with ASD calls for directed attention to the transition planning process. The findings help provide direction for future implementation research on transition for students with ASD.

10:50 **139.002** Effects of a Parent-Training Intervention on Service Access and Employment for Youth with ASD

J. L. Taylor[1,2], *R. M. Hodapp*[2], *M. M. Burke*[3], *S. N. Waitz-Kudla*[2] *and C. Rabideau*[2], *(1)Vanderbilt University Medical Center, Nashville, TN, (2)Vanderbilt Kennedy Center, Nashville, TN, (3)University of Illinois at Champaign-Urbana, Champaign, IL*

Background: When youth with autism spectrum disorder (ASD) leave high school, they encounter an adult service system that is underfunded and difficult to navigate; this serves as a significant barrier to accessing appropriate services and support. In response, our group developed the Volunteer Advocacy Program-Transition (VAP-T), which equips parents to more effectively navigate the adult service system on behalf of their son/daughter with ASD. In initial findings from a small randomized controlled trial (RCT), we found that relative to control group parents, those who participated in the VAP-T knew more about adult services, and felt more empowered and skilled in advocating. It is unclear, however, whether increased parental knowledge/empowerment leads to improved transition outcomes for youth.
Objectives: To test whether parent participation in the VAP-T led to increased service access and higher rates of community employment/post-secondary education (PSE) for transition-aged youth with ASD.
Methods: We examined the efficacy of the VAP-T using an RCT, waiting-list control design with families of youth with ASD who were within 2 years of high school exit. After completing pre-test measures, families were randomly assigned to the intervention group or a wait-list control. Parents in the intervention group met weekly for 12 weeks; each session lasted 2.5 hours. Sessions covered aspects of the adult service system (e.g., Vocational Rehabilitation, post-secondary education programs, SSI, SSDI) and advocacy skills. All youth had ASD diagnoses confirmed using the Autism Diagnostic Observation Schedule-2 administered by research-reliable clinicians. 38 families (19 treatment, 19 control) have completed the 6-month follow-up thus far. At this time, 55% of youth were in high school and 45% had exited. The sample of youth was 18% female, and 32% had an intellectual disability. Outcomes, measured six months after the intervention group completed the VAP-T, included the number of services youth were receiving and whether youth were currently working in the community or in a PSE program.
Results: Youth with ASD whose parents were in the treatment group were more than twice as likely as the control group to be working in the community or in PSE (47% vs. 21%), Fisher's Exact Test p-value = .09. Group effects were more pronounced for those out of school; 86% of treatment group youth who had exited high school were working in the community or in PSE, compared to 30% of control group youth, Fisher's Exact Test p-value = .04. Relative to the control group, treatment group participants may be receiving more services (3.60 vs. 3.00), although the difference was not statistically significant. Further analyses will examine whether intervention effects on service access depend on high school exit (in/out of high school) or whether the youth has an intellectual disability.
Conclusions: Â Training parents how to navigate the adult service system may lead to higher rates of employment/PSE participation for youth with ASD, and perhaps to better service access. Discussion will highlight the importance of intervening at the level of the family, when working to strengthen environmental supports for youth with ASD during the transition to adulthood.

11:10 **139.003** Realist Evaluation of Specialist Peer Mentoring for University Students with ASD

C. Thompson[1,2], *T. Falkmer*[1,2], *S. Taylor*[1], *S. Bolte*[3,4,5] *and S. J. Girdler*[1,2], *(1)School of Occupational Therapy and Social Work, Curtin University, Perth, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (3)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Institutionen för kvinnors och barns hälsa (KBH), Karolinska Institutet, Stockholm, Sweden, (4)Curtin University, Bentley, Australia, (5)Stockholm County Council, Center for Psychiatry Research, Stockholm, Sweden*

Background: While many adults with Autism Spectrum Disorder (ASD) have average to high intellectual capabilities they still experience numerous challenges impacting their ability to negotiate everyday life. Post-secondary education has been identified as a means of improving outcomes in adulthood. Despite recognition of the benefits of education and intellectual abilities of many adults with ASD, the rate of those completing post-secondary education remains below those of others with and without disabilities. Specialist peer mentoring for adults with ASD has been proposed as an intervention that may enable success at university.
Objectives: This study aimed to identify the contexts, mechanisms and outcomes; and the relationship between these components of a specialist peer mentor program for university students with ASD.
Methods: Semi-structured interviews were explored a specialist peer mentor intervention for university students with ASD. The Realist Evaluation (RE) method provided a structured approach allowing for exploration of the contexts, mechanisms and outcomes of the program. RE facilitated the exploration of how the program worked, under what conditions, and what outcomes occurred as a result.
A total of 28 (23 female and 5 male; mean age=28.6; SD=6.9) peer mentors supporting university students with ASD completed semi-structured interviews ranging in duration from 30 to 90 minutes. Interviews were transcribed verbatim and systematically coded using the *context, mechanism* and *outcome* framework. The *context* of the program was considered circumstances present prior to the peer mentoring program, including aspects of the person, available services and the environment. The *mechanisms* were the components of the peer mentoring program; and the *outcomes* were the expected or unexpected consequences of *mechanisms* in a particular *context*. Following broad coding into categories of *context*, *mechanism* and *outcome*thematic coding was undertaken within each category.
Results: A total of 312 contexts, 961 mechanisms and 283 outcomes were identified. Within the context category thematic analysis revealed the themes of *university services*, *university course demands*, *environmental conditions* and *individual differences*. Themes within the mechanisms were *problem solving, the mentor*, *the structured program,* and *social interactions*. While the themes of *identifying positive mentor outcomes, identifying personal strengths*, *achieving goals*, *increased* independence and *mentor-mentee relationship*were identified within the outcomes.
Conclusions: The mechanisms of particular interest within the intervention were *problem solving* and *the mentor*. It is particularly interesting that even though ASD is a condition characterised by social communication difficulties several of the most pertinent mechanisms of the present intervention were forms of communication and social interaction. These findings indicate that to work effectively with university students with ASD mentors need to utilise therapeutic use-of-self and modelling to foster social communication and participation at university. It is also suggests that adults with ASD are able to effectively model social behaviours from their peer mentors. Modelling of appropriate and effective communication strategies by peer mentors is a powerful intervention to increase self-efficacy in social-communication for university students with ASD. Further research is required to describe the dynamics of the peer mentoring relationship and the impact of this intervention on ASD symptomatology.

11:30 **139.004** Working Together: Family Education and Support Intervention for Young Adults with ASD

***L. E. Smith**, J. S. Greenberg and M. R. Mailick, Waisman Center-University of Wisconsin, Madison, WI*

Background: Â Currently there is increasing interest in developing interventions to support positive outcomes across the lifespan for individuals with ASD. Given the current dearth of *formal* services for young adults with ASD, especially those without co-occurring intellectual disability, interventions are needed that increase a family's capacity to find and create *informal* supports and activities in the community. Addressing this gap, we developed a multi-family group psychoeducation intervention, *Working Together*, designed for disengaged young adults with ASD and their families.
Objectives: The present study aimed to evaluate the impact of *Working Together*, a multi-family group psychoeducation intervention for young adults with ASD, on (1) frequency of employment, (2) frequency of social interactions, and (3) supportive parental attitudes.
Methods: Data were drawn from the ongoing *Working Together* study. Young adults were eligible to participate if they coresided with their parents, had no intellectual disability, and had a medical/educational diagnosis of ASD confirmed by administration of the Social Communication Questionnaire. The present analysis focused on 17 adults and their parents who had completed data through 6-month follow up (40 families will be completed by IMFAR). After baseline assessment, families were randomized into an intervention (n=9) or waitlist control condition (n=8). The intervention included 2 individual family sessions, 8 weekly group sessions, 3 monthly group booster sessions, and ongoing resources and referrals. Although group sessions occurred separately for young adults and their parents, session topics were the same and included goal setting, problem-solving, coping strategies, planning for independence, and employment. Adults with ASD and their parents were assessed at baseline and at 6 month follow up on measures of employment, social interactions, and parental attitudes. Families also reported on satisfaction with the program.
Results: To test for differences between experimental and control groups at 6 month follow-up, we conducted a series of 2 (group) by 2 (time) repeated measures ANOVAs. Young adults in the intervention group showed improvements in frequency of working for pay based on both young adult and parent report compared to young adults in the control group (*partial eta squared* = .218 and .154 for parent- and young adult-report, respectively, representing medium effect sizes). Parents in the intervention group also showed more supportive attitudes about their young adult following the intervention compared to parents in the control group, *partial eta squared* = .263, reflecting a large effect size. There were no significant differences between groups over time for time spent with friends. Additionally, 100% of parents and adults with ASD were satisfied or very satisfied with the intervention program. Exit interview data suggested problem solving and independence were important areas of learning for the young adults.
Conclusions: The *Working Together* intervention was associated with increased paid employment for young adults with ASD as well as improved parental attitudes, suggesting benefits of family support for adult outcomes. Future research will examine the effectiveness of the *Working Together* model on quality of life and long-term employment and engagement in adults with ASD.

Panel Session
140 - Variability at the Minimally Verbal End of the Spectrum: Evidence from Biology and Behavior
10:30 AM - 12:00 PM - Yerba Buena 9

Panel Chair: Charlotte DiStefano, *University of California Los Angeles, Los Angeles, CA*

Discussant: Shafali Jeste, *UCLA, Los Angeles, CA*

Approximately 25-30% of individuals with ASD remain minimally verbal (MV) despite access to intervention (Anderson et al., 2007; Tager-Flusberg & Kasari, 2014). Although unified by the lack of spoken language, the MV ASD population exhibits considerable heterogeneity with regard to cognitive, social and receptive language abilities (DiStefano et al., 2016; Bal et al., 2016). This variability likely results from the fact that many different pathways can lead to expressive language impairment. Improving outcomes for this subgroup of the autism spectrum requires better characterization and understanding of this variability. This panel will present research from multiple levels of investigation within the MV spectrum, from brain to behavior. Panel presentations will include electrophysiological investigation of auditory, visual and lexical processing in both MV and verbal children with ASD, prosodic and acoustic characteristics of speech in MV children, and emotional/behavioral profiles of children with ASD across language levels. Throughout the presentations, we will discuss differences between MV and verbal children with ASD, variability within the MV group, and we will consider the ways in which these findings can inform our understanding of pathways to and outcomes of language impairment in the ASD population.

10:30 **140.001** Sensory Perception and Lexical-Semantic Processing in Minimally Verbal/Non-Verbal Children with ASD and Typical Controls Assessed Via Dense-Array EEG

C. Cantiani[1], *V. Shafer*[2], *Y. H. Yu*[3], *N. Choudhury*[4] *and A. A. Benasich*[5], *(1)Child Psychopathology Unit, Scientific Institute IRCCS Eugenio Medea, Bosisio Parini, Italy, (2)The Graduate Center, City University of New York, New York, NY, (3)Department of Communication Sciences and Disorders, St. John's University, New York, NY, (4)Psychology, Ramapo College of New Jersey, Mahwah, NJ, (5)Center for Molecular & Behavioral Neuroscience, Rutgers Univ., Newark, NJ*

Background:
We examined electrocortical activity associated with sensory perception (visual and auditory) and lexical-semantic processing in nonverbal (NV) or minimally verbal (MV) children with Autism Spectrum Disorder (ASD). Studies that have examined the neural correlates of higher-level linguistic processing in this population are rare. Specifically, there is no agreement on whether NV/MV ASD children as a group perceive and comprehend incoming linguistic input and whether speech, if perceived, is processed in a manner comparable to that of typically developing children. However, this is far from a homogenous group and our research, as well as that from other labs, suggests much individual variation across cognitive, social and receptive language domains. A key challenge in assessing this population is developing approaches to evaluating linguistic and cognitive abilities that do not confound linguistic performance with difficulties meeting task demands.
Objectives:
The purpose of this study was to use dense-array electroencepahalography (EEG) to examine the topography and time course of sensory/perceptual and higher-order linguistic skills in NV/MV children with ASD, and to compare their cortical responses and processing profiles to related visual and auditory input with that of typically developing children.
Methods:
Event related potentials (ERPs) of 10 NV/MV children with ASD and 10 neurotypical children (age range 4-7 years) were recorded during a passive picture-word matching paradigm. Still pictures of animals or inanimate objects were visually presented on a computer monitor while a word that either matched or mismatched the picture was auditorily presented. The specific paradigm used allowed us to investigate the entire pattern of information processing, from very early sensory perception (for both visual and auditory processing) through to lexical-semantic processing.
Results:
Atypical ERP responses were evident at all levels of processing in children with NV/MV ASD. Basic perceptual processing of visual and auditory stimuli was found to be significantly delayed but similar in amplitude and topography to control children. More significant differences were seen between children with ASD and typically developing children at the lexical-semantic level, suggesting more compromised higher order processes. Individual level analyses revealed that a reliable N400 component in response to the mismatch condition was detected in five of the ASD children and eight of the neurotypical children.
Conclusions:
These results suggest that although basic perception is relatively preserved in NV/MV children with ASD, higher levels of processing are impaired. However, we were also able to examine individual processing profiles, an important step in using such information to guide intervention. Thus, these studies represent a significant step towards developing a functional neurolinguistic assessment for this difficult-to-test population. The findings also challenge the notion that being nonverbal (i.e. “no spoken language”) implies an absence of language comprehension. In some individuals that may indeed be true, however, we have demonstrated that at least a subset of nonverbal ASD children may possess higher-level language processing skills than is evident from standardized testing procedures.

10:50 **140.002** ERP Evidence of Semantic Processing in Children with ASD

C. DiStefano[1], *A. T. Marin*[2], *E. Baker*[3] *and S. S. Jeste*[4], *(1)University of California Los Angeles, Los Angeles, CA, (2)University of California, Los Angeles, Los Angeles, CA, (3)UCLA Center for Autism Research and Treatment, Anaheim, CA, (4)UCLA, Los Angeles, CA*

Background:
Language outcomes vary in children with ASD, with up to 30% remaining minimally verbal (MV). Electroencephalography (EEG) yields information about an individual’s neural response to a stimulus in real time, and in the context of language impairment may elucidate neural mechanisms underlying language processing in ASD. Lexical-semantic processing can be quantified through a paradigm in which information is presented in a semantically congruent or incongruent way (Bentin 1985; Hagoort et al., 2008). This paradigm has been recommended for assessing receptive language in individuals with limited speech (Connolly et al., 1999). The EEG response after the incongruent presentation (N400) has been found to be reduced in both high-functioning (Dunn & Bates, 2005) and MV children with ASD (Cantiani et al., 2016). No study has examined variability in semantic processing within children with ASD and, in particular, whether EEG correlates of semantic processing relate to direct assessment of language.
Objectives:
We examine EEG correlates of lexical-semantic processing in a large, heterogeneous sample of children with ASD, compared with an age-matched typically developing (TD) group, and we investigated the relationship between lexical-semantic processing and receptive language. We hypothesized that children with ASD would show a reduced N400 response compared with TD children and that larger, faster N400 response would be associated with better receptive language.
Methods:
Verbal and MV children with ASD (ages 5-11; n=16 in each group), and an age-matched TD group (N=18) participated in a semantic congruence EEG paradigm, during which pictures were displayed followed by the expected (match) or unexpected (mismatch) spoken word. EEG data were collected using a 128-electrode Hydrocel Geodesic Sensor Net System (EGI), filtered at 0.3-30 Hz, and processed in NetStation. Participants with a minimum of 10 artifact-free segments per condition were included in analysis. Assessments included Differential Ability Scales (IQ), Peabody Picture Vocabulary Test (receptive vocabulary) and Autism Diagnostic Observation Schedule (diagnostic confirmation).
Results:
The mismatch condition elicited an N400 component in all groups (F=5.43, p=.024), with a shorter latency in the TD group (t=-3.15, p=.003). N400 latency was negatively correlated with receptive vocabulary (r=-.33, p=.03). A late negative component (LNC; 550-900ms) also was evident in the mismatch condition, with a group by condition by region interaction (F=2.5, p=.026). *Post hoc* analyses revealed that the LNC was present across frontal and central regions in the TD group (p-values .05-.002), in the mid-central region in the MV ASD group (t=2.5, p=.03), and approaching significance in the mid-frontal region in the V ASD group (t=1.99, p=.06).
Conclusions:
Findings indicate that both MV and verbal children with ASD demonstrate some EEG evidence of semantic processing, but their processing may be delayed and have reduced integration with mental representations. This supports the notion that at least some MV children show higher-level lexical processing, and performance on this task may be a meaningful stratification biomarker for understanding differential language trajectories. These findings differ from previous studies that did not find significant N400 response in children with ASD, likely due to our larger sample size and differences in the experimental paradigm.

11:10 **140.003** Vocalizations of Minimally Verbal Children and Adolescents with Autism: A Prosodic and Acoustic Analysis

J. C. Thorson[1] *and H. Tager-Flusberg*[2], *(1)Boston University, Croydon, NH, (2)Psychological and Brain Sciences, Boston University, Boston, MA*

Background:
Variations in prosody convey lexical, grammatical, and pragmatic meaning, all essential for successful communication. Individuals with autism spectrum disorder (ASD) show deficits in communication and pragmatic use of language (Tager-Flusberg Paul & Lord, 2005), with mixed results for how stress, intonation, and phrasing distinctions are employed (Paul et al., 2005; McCann et al., 2007; Shriberg et al., 2001). Critically, research to date has largely focused on verbal individuals with ASD, and only a few studies include acoustic analyses to more closely examine the nature of expressive impairments (Baltaxe, 1984; Diehl et al., 2009).
Objectives:
The current investigation was designed to elucidate the prosodic abilities of minimally verbal school-aged children with ASD, a previously understudied population, in an effort to better understand communication abilities across the spectrum. Due to challenges in collecting data from a population with a range of behavioral and intellectual issues, research has been limited within this group. Our goal was to acoustically analyze different types of vocalizations to better identify and understand natural prosodic features.
Methods:
Speech from 24 minimally verbal children and adolescents was analyzed (see Table 1). All speech was extracted from a standardized interview (ADOS) and labeled as spontaneous, echolalia, or elicited imitation. Average F_0 was extracted from successive 250-ms time windows, resulting in four data points per second. *Average pitch* is the average of these data points, and p*itch range* is the standard deviation in average F_0. Due to the heterogeneity of this population, we predicted that participants would demonstrate differences in prosody through the varied use of F_0, with pitch fluctuating as a result of verbal ability. This is in contrast to typically developing populations where variability stabilizes over time. Verbal ability was measured by analyzing how many unique words were uttered during the assessment (Lexical Score), allowing for a more fine-grained verbal analysis.
Results:
Substantial prosodic variation was observed across participants. Strong correlations were found between Lexical Score and the child's score on a parental questionnaire of receptive and expressive vocabulary ($r(21) = .758$, $p < .001$; $r(21) = .786$, $p < .001$, respectively). Lexical Score negatively correlated with *average pitch*, with more verbal children demonstrating lower overall pitch ($r(20) = -.563$, $p = .006$). *Pitch range* varied more within spontaneous productions than the echolalia and elicited imitations, the latter two showing overall greater variation in range (Figure 1). In comparison to previous research with verbal children with ASD and typically developing children, our data show more pitch range variation for minimally verbal children (Diehl et al., 2009).
Conclusions:
Results indicate that participants vary considerably in how they modulate pitch during different types of speech productions. This first exploration into the prosodic patterns of pitch in minimally verbal school-aged children with ASD provides further insight into how prosody varies along the autism spectrum. We also investigated how pitch varies for this group as a function of speech type, shedding light on unique processing and production strategies. Identifying prosodic characteristics aids early intervention strategies and provides a baseline for melodic-based therapies.

11:30 **140.004** Assessing Emotional/Behavior Problems in Children with ASD: Differences in ABC and CBCL Profiles By Language Level

M. Fok[1]*, E. Rosenberg*[1] *and V. Hus Bal*[2]*, (1)University of California, San Francisco, San Francisco, CA, (2)STAR Center for ASD & NDD; Dept of Psychiatry, University of California, San Francisco, San Francisco, CA*

Background:
There has been an increasing focus on assessment of social-communication, cognitive and language skills in minimally verbal (MV) children (Kasari et al., 2013), but little attention to psychiatric comorbidities in this clinical population. The Child Behavior Checklist is commonly used to assess emotional/behavior problems (EBP; Achenbach & Rescorla, 1991), but includes items reflecting internal experiences that may be difficult to evaluate in MV children. The Aberrant Behavior Checklist (Aman et al., 1985) was developed to assess EBP in individuals with intellectual disability (ID); it may be well-suited for assessing MV children but miss more internalized experiences of verbal children. Previous studies suggest the ABC is appropriate for use with children with ASD (Kaat et al., 2014); no study has examined whether item response patterns vary by child language level.
Objectives:
Examine the utility of the ABC and CBCL for assessing EBP in children with ASD across different language levels and use items from the ABC to gain insight into how EBP may manifest differently in MV vs. verbal children.
Methods:
Participants were 1,964 6-18 year olds with ASD from the Simons Simplex Collection. ABC (Irritability, Lethargy, Hyperactivity) and CBCL (Internalizing, Externalizing) were used to examine EBP. ADOS module was used as a proxy for language level (Module 1=MV, 2=phrases (P), 3=verbally fluent (VF)). One-way Analysis of Variance with post-hoc Bonferroni tests were used to compare EBP across language levels. Chi square analyses were used to assess language group differences in a)children meeting clinical cut-offs for CBCL subscales and b)ABC item response patterns. Correlations between EBP, ASD symptoms and IQ were assessed within language groups.
Results:
Each ABC subscale showed language group differences (all $p<.001$). MV children had higher Lethargy scores than P and VF groups ($p<.001$), but differed from only the VF group on Hyperactivity and Irritability (MV>VF, $p<.001$). On the CBCL, language groups showed different Internalizing ($p<.001$), but not Externalizing scores ($p=.48$). In contrast to the ABC, the VF group had higher Internalizing scores than MV or PS groups ($p<.001$). Within the Internalizing domain, only 1% of the MV group fell in the range of clinical concern (t-score ≥ 70) on the Anxious/Depressed subscale, compared to 4% of the PS and 20% of the VF group ($p<.001$). Scores on other Internalizing subscales did not differ by language level.
Across the three ABC scales, seven items showed similar response patterns across language groups. Scales also showed differential relationships with IQ and ASD symptoms across language levels, including within the MV group. Language group differences in item distributions and associations with other child characteristics will be discussed with respect to differences in manifestation of ASD symptoms and overlap with EBP in MV vs. verbal children.
Conclusions:
The ABC and CBCL showed different patterns of EBP across language levels, underscoring a need for careful consideration of the assessment of EBP in MV children. Findings have implications for the use of ABC and CBCL in large samples of varying language abilities, as EBP may manifest differently in MV and verbal children.

Poster Session
141 - Brain Structure (MRI, neuropathology)
12:00 PM - 1:40 PM - Golden Gate Ballroom

31 **141.031** Age-Related Changes in Cortical Morphometry; A Longitudinal MRI Study of Males with Autism and Controls.

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Background:
Cortical volume (CV) is the product of 2 underlying components: cortical thickness (CT) and surface area (SA). This is of importance because both CT and SA have distinct genetic and developmental origins. Hence measurement of CT and SA allows us to 'fractionate' the underpinning mechanisms behind differences in brain volume in people with autism spectrum disorders (ASD), and to investigate how these differ over time.
Objectives:
We acquired structural MRI over multiple time periods to investigate brain morphometry and growth trajectory differences between individuals with ASD and typically developing controls.
Methods:
We included 64 males – 32 with ASD and 32 controls. ASD was diagnosed using ADI and ADOS. We obtained 62 scans from individuals with ASD (mean age = 15 years; range 6-19 years; mean inter-scan interval 1.1 years) and 54 scans from 32 typically developing controls (TDC) males (mean age = 14 years; range 8-19 years; mean inter-scan interval 1.0 years). FreeSurfer, image analysis software, was used to measure CV, CT and SA. Automatic longitudinal processing was used to obtain reliable measurements at each time point. Cross-sectional between group (i.e. TDC, ASD) comparisons at baseline were carried out using a general linear model and the SurfStat toolbox. Differences in developmental trajectories over multiple time points were investigated using linear mixed effects models.
Results: At baseline, there are main effects of group for CV and SA. The ASD group had significantly greater CV and SA in insula/postcentral gyrus. There was no difference in CT. Longitudinal analysis revealed significant age related changes in CV, CT and SA globally in both groups. However, the ASD group showed more CV, CT and SA reductions with age than the TD group globally in frontal, temporal, parietal, and occipital lobes.
Conclusions:
Individuals with ASD have significantly greater age-related loss of brain tissue than controls. Larger studies, and including older (and aged) populations, are required to determine if these age-related differences are associated with change in symptomatic and/or cognitive profile.

32 **141.032** Altered Functional and Structural Brain Connectivity in ASD Individuals with SHANK3 Defect

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Background: SHANK3 is a postsynaptic scaffolding protein, whose molecular variations is thought to be responsible for 22q13 deletion syndrome (Phelan-McDermid Syndrome) and autism spectrum disorders (ASD). However, it remains unclear how SHANK3 defect are related to abnormal brain development in ASD.
Objectives: To assess the GM and WM development of SHANK3 defect children ascertained for ASD and explore the relationship with clinical phenotypes.
Methods: MLPA and Sanger sequencing were carried out to confirm the *SHANK3* deficiency of 8 Chinese children with ASD (SHANK3 group), followed by systematic and comprehensive evaluations. Then we recruited 24 ASD children without *SHANK3*deficiency (ASD group) and 25 typically developing controls (TD group). ADOS scale was applied to examine the severity of autism and Griffith scale was used to assess the development level of SHANK3 group and ASD group. In addition, MRI scans of the three groups were analyzed using voxel-based morphometry (VBM) and Diffusion tensor imaging (DTI). Normalized modulated GM maps were statistically analyzed using the general linear model. The integrity of WM fiber was evaluated using fractional anisotropy (FA).
Results: Six participants lacked the whole gene of *SHANK3*, one lacked part of it, and one with de novo *SHANK3* mutation was included. The sample was characterized by high rates (100%) of ASD, developmental delay, hypotonia, several dysmorphologies and perception abreaction. As to the clinic phenotypes, there was no significant statistical difference between SHANK3 and ASD group. Whereas SHANK3 defect children displayed severer developmental delay in language, performance and other items comparing with ASD group ($p<0.0005$). As to the MRI performance, VBM showed that SHANK3 group showed significant gray matter volume decrease in the left middle frontal gyrus, right postcentral and left dorso-lateral superior frontal gyrus, compared with TD and ASD group ($p<0.001$). What's more, SHANK3 group had significantly less gray matter in the left cerebellar crus, left triangle inferior frontal gyrus, left inferior parietal and left fusiform gyrus than ASD group ($p<0.001$). Additionally, as to the DTI result, corpus callosum (body, splenium and genu) tracts in SHANK3 group displayed significantly lower FA than ASD and TD group ($p<0.001$). Other tracts, such as middle cerebellar peduncle, bilateral superior and anterior corona radiate and bilateral superior longitudinal fasciculus, also had significant abnormalities ($p<0.001$).
Conclusions: These results imply that *SHANK3* defect associated with ASD may be rooted in neural anatomy, and autism symptoms in individuals with *SHANK3* defect and ASD might have, at least partially, different underlying etiologies. Moreover, an obvious phenomenon of imbalance between left and right side in *SHANK3* defect children was existed, which may be associated with the different functions of each brain region and the diversity of clinical phenotypes.

33 **141.033** Amygdala Growth Trajectories, Fear Potentiated Startle Response, and Anxiety in Children with Autism Spectrum Disorder

L. Libero[1], *A. Schneider*[2], *D. Hessl*[3], *B. Winder-Patel*[4], *M. Solomon*[5], *C. C. Coleman*[5], *N. Sharma*[3], *C. W. Nordahl*[5] *and D. G. Amaral*[5], *(1)Psychiatry and Behavioral Sciences, University of California, Davis, MIND Institute, Sacramento, CA, (2)Pediatrics / MIND Institute, University of California at Davis, Sacramento, CA, (3)UC Davis MIND Institute, Sacramento, CA, (4)MIND Institute, University of California, Davis, Sacramento, CA, (5)Department of Psychiatry & Behavioral Sciences, University of California-Davis, Sacramento, CA*

Background: Symptoms of anxiety are reported commonly in ASD, with approximately 40-50% of individuals with ASD meeting criteria for an anxiety disorder (Kerns & Kendall, 2012). Alterations in amygdala morphology and activity are also commonly reported in ASD, yet the relationship between alterations in the amygdala and the development of co-morbid anxiety disorders is unclear. Given that the amygdala is functionally related to fear and anxiety (Amaral et al., 2003), investigating amygdala growth trajectories and probing amygdala function using a fear potentiated startle paradigm may provide insight into autism-related anxiety disorders that emerge during middle childhood.
Objectives: To examine amygdala growth trajectories, fear potentiated startle response and clinically significant anxiety in children with ASD and age-matched typically developing (TD) children.
Methods: Participants to date include 22 children with ASD (15 male/7 female; IQ range 32-138; ADOS-2 composite score range 3-10) and 14 typically developing children (10 male/4 female; IQ range 98-140). The children are currently between 9 and 13 years of age and enrolled in the ongoing Autism Phenome Project. T1-weighted structural MRIs were collected for each child at around 2-3 years-of-age and again at present. Amygdala volumes were measured bilaterally at each age based on these scans. The rate of amygdala growth was calculated as the change in volume over time, normalized to total brain volume growth. Fear potentiated startle response was measured as a probe of amygdala function. The fear potentiated startle response was evaluated using a paradigm previously tested in adolescents with ASD (Sterling et al., 2013) that was adapted for testing with children with low IQ and limited verbal abilities. Clinically significant anxiety was measured using the Anxiety Disorders Interview Schedule (ADIS-IV) with the Autism Spectrum Addendum.
Results: In the fear potentiated startle task, children with ASD had significantly reduced mean percent potentiation compared to TD children. Interestingly, the ASD group also demonstrated significantly increased baseline startle magnitudes. Within the ASD group, the rate of amygdala growth was negatively correlated with percent fear potentiation such that children with the fastest amygdala growth rates demonstrated the most reduction in percent fear potentiation. In addition, percent fear potentiation was also significantly correlated with the clinical severity rating scores for each child's principal anxiety diagnosis. Children with ASD and the highest ratings of anxiety demonstrated the greatest level of fear potentiation.
Conclusions: A significant association between amygdala growth and fear potentiated startle response suggest that alterations in the developmental trajectory of the amygdala may be driving the reduced fear response in the ASD group. At the same time, greater fear potentiated startle response was related to higher clinical ratings of anxiety, indicating that this probe of amygdala function may be a useful tool for evaluating anxiety level particularly in non-verbal lower functioning individuals.

34 **141.034** Anatomical Connectivity Abnormalities and Social Perception Deficits in Children with ASD: A MRI-DTI and Eye-Tracking Study

A. Vincon-Leite[1], *A. Saitovitch*[1], *H. Lemaître*[2], *J. M. Tacchella*[1], *E. Rechtman*[1], *E. Douard*[1], *N. Chabane*[3], *A. Philippe*[4], *D. Grevent*[1], *R. Calmon*[1], *F. Brunelle*[1], *N. Boddaert*[1] *and M. Zilbovicius*[1], *(1)INSERM U1000, Institut Imagine, Paris, France, (2)INSERM U1000, Institut Imagine, Université Paris Sud, Paris, France, (3)INSERM U1000, Paris, France, (4)UMR 1163, Institut Imagine, Paris, France*

Background: Autism spectrum disorder (ASD) is highly heterogeneous. Nevertheless, a core deficit in social interaction, notably a difficulty to establish a direct eye-contact, constitutes a frequent characteristic across the autism spectrum. Eye-gaze behaviour, crucial for human interaction, can be measured objectively with eye-tracking methodology. Moreover, it is now admitted that these social human abilities, disrupted in ASD, have a neural substrate. In a network point of view, recent advances in brain imaging as diffusion tensor imaging (DTI) permit to explore white matter (WM) microstructure mediating anatomical connectivity.
Objectives: In this context, after demonstrating that in our cohort, children with ASD met atypical eye-tracking pattern compared to typical developed (TD) children, the current study sought to investigate (i) whether children with ASD exhibit differences in WM microstructure approached by fractional anisotropy (FA) compared to TD children (ii) whether WM microstructure correlates with individual tendency to drive more or less interest to the eye region, which can be viewed as a social perception indicator.
Methods: Twenty-eight children with ASD (age = 8.4 ± 4) and twenty-five TD children (age = 10.4 ± 3) participated in this study. ASD diagnosis was based on DSM IV-R and ADI-R criteria. Tobii-T120 eye-tracker was used to measure eye-gaze processing during passive visualization of social movies, displaying two characters engaged in peer to peer social interactions. WM integrity was voxel-wise assessed over the whole brain diffusion tensor imaging (DTI). Diffusion data were acquired on a GE-Signa 1.5T using an echoplanar sequence (40 directions, TE=70 ms; TR=8800 ms; 2*1.8*1.8 mm3; b=1500 s/mm2). We used a whole-brain Tract-Based Spatial Statistics method. Firstly, whole brain FA values were compared between ASD and TD children controlling for age. Subsequently, whole brain correlation analysis was performed between normalized DTI images and the number of fixations to the eyes. For both analyses general linear model framework within FSL was used.
Results: Compared with the TD group, the ASD group had significantly reduced FA values ($p < 0,05$, corrected) in the fronto-temporo-parietal circuit, in particular in the right arcuate fasciculus, which connects frontal to temporal regions, known to be important for social perception and cognition. Moreover, the results for ASD children showed a significant positive correlation between FA values and number of fixations in the eyes in widespread clusters including the entire bilateral arcuate fasciculus. Interestingly, we found a significant interaction between groups and number of fixations in the eyes ($p <0,05$, uncorrected), localised in the right anterior temporal pole. In this anterior temporal region, ASD FA values strongly correlate with the number of fixations in the eyes whereas TD children FA values seem to be constant independently of the eye fixation.
Conclusions: The present study showed differences in WM connectivity between ASD and TD children, particularly in temporal regions. In addition, for the first time to our knowledge, we describe a significant correlation between the anatomical brain connectivity within temporal regions and an objective measure of visual social perception. Interestingly, taken together these results point to common temporal abnormalities across the autism spectrum.

35 **141.035** Associations Between White Matter Diffusion Properties and ASD Impairments: A Tract-Based Spatial Statistics Study

C. Buckless[1], *D. Crocetti*[2], *N. Wymbs*[2,3] *and S. H. Mostofsky*[2], *(1)716 North Broadway, Kennedy Krieger Institute, Baltimore, MD, (2)Kennedy Krieger Institute, Baltimore, MD, (3)Neurology, Johns Hopkins University, Baltimore, MD*

Background:
Autism spectrum disorder (ASD) has often been characterized as a disorder of connectivity. Studies have revealed white matter anomalies across a wide range of networks including those commonly associated with ASD such as motor and social networks. Diffusion tensor imaging (DTI) has been used to investigate structural connectivity across major white matter pathways. In an effort to shed light on the inconsistent and widespread findings from prior studies, we opted to utilize an unbiased approach for localizing anomalous regions of white matter connectivity in children with ASD. This study employed tract-based spatial statistics (TBSS), a non-hypothesis driven approach of the whole brain rather than localized regions and/or networks.
Objectives:
To isolate differences within FA and MD and symptom severity between children with ASD and typically developing (TD) children within major white matter connections of the whole brain.
Methods:
Diffusion weighted imaging was acquired on 50 children with ASD and 50 TD children aged 8-12 years. Groups were balanced for sex, age and cognitive ability. All children were right handed. TBSS was used to create a skeleton of major white matter tracts. A whole brain voxel wise analysis was performed to identify areas of significant difference within the white matter skeleton between groups for fractional anisotropy (FA) and mean diffusivity (MD). Threshold-free cluster enhancement was used to control for multiple comparisons. Atypical white matter regions in ASD were localized using a standardized whole brain atlas. Pearson's correlations were used to examine associations between MD and symptom severity.
Results:
Preliminary analysis from TBSS revealed widespread increased MD in children with ASD as seen in Figure 1. When these significant networks are overlaid with the standardized whole brain atlas, findings were localized to 39 of the 90 regions; all but 10 of these 39 regions lie in the left hemisphere. Pearson's correlation further revealed a positive correlation in children with ASD between the MD and ADOS communication score in 10 regions with only two within the right hemisphere. These regions included the left body of the corpus callosum (p=0.045, r=0.285), left cuneus (p=0.018, r=0.334), left lingual gyrus (p=0.017, r=0.335), left precentral gyrus (p=0.049, r=0.279), left inferior occipital gyrus (p=0.041, r=0.290, left middle occipital gyrus (p=0.004, r=0.404), left posterior thalamic and optic radiation (p=0.020, r=0.327), left superior corona radiate (p=0.038, r=0.294), right angular gyrus (p=0.020, r=0.327), and right middle occipital gyrus (p=0.010, r=0.361). No differences in FA were observed.
Conclusions:
Consistent with prior findings, we found that children with ASD show increased MD in major white matter regions including but not limited to motor and social networks predominately within the left hemisphere. This left lateralization is supported by several studies have found networks including motor and social networks to have decreased FA and increased MD in children with ASD. Increased MD in children with ASD is associated with increased impairment in communication including functional, social and gestural communication as measured by the ADOS communication score.

36 **141.036** Biological Sex Modulations on Cortical Thickness in Autism Spectrum Disorder: An Analysis of Autism Brain Imaging Data Exchange II

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Background: There is a higher prevalence of males diagnosed with autism spectrum disorder (ASD) than females. This disproportionality in pathology is a question of great interest, but it is still largely unknown on the underlying neural basis of the sex differences. Large scale data sharing, such as ABIDE (Autism Brain Imaging Data Exchange) has enabled the study of sex differences in brain structures and functions (Di Martino et al., 2014). Analyses of ABIDE I data have shown similar expanded gray matter volumes in bilateral temporal lobe in females and males (Di and Biswal, 2016), and sex-dependent gyrifications in the ventromedial prefrontal cortex (Schaer et al., 2015). With the latest release of ABIDE II, we aimed to examine sex modulations on cortical thickness alterations in children with ASD.
Objectives: To determine if there exist sex-dependent or sex-independent brain structural alterations in children with ASD compared with typically developing (TD) children.
Methods: A total of 552 subjects were used from ABIDE II, with sites that have at least 2 females with ASD. Subjects younger than 20 years old and with those with a full scale IQ greater than 70 were included. Exclusions taken into account, leave us with ASD pool of 237 children (42 females) and 315 TD children (115 females). With a 2 (diagnosis) by 2 (sex) design, we examined whether there are brain alterations in ASD compared with TD that are modulated by sex (a diagnosis by sex interaction) or similar in both sexes (a diagnosis main effect).
T1 weighted MRI (magnetic resonance imaging) images were analyzed using FreeSufer. It performs skull stripping, gray-white matter segmentation, and cortical thickness, a measure of the distance between the white matter and pial surfaces. A 15 mm^2 Gaussian smoothing was applied. Using FreeSufer's Query, Design, Estimation, Contrast (QDEC) application a 2 x 2 factorial design was created, with diagnosis and gender as factors, and age, IQ, and site of scan serving as cofactors. Statistical analysis was done for each hemisphere. Clusters are initially threshold at $p < 0.01$ to find clusters of interest, followed by Monte Carlo cluster-level multiple comparison with $p < 0.05$.
Results: One region in the right lateral occipital cortex revealed a diagnosis by sex interaction (Figure 1A) (cluster size = 2171.66 mm^2, Talairach coordinates: 45.1, -72.2, 6.5). In addition, the anterior cingulate cortex in the left hemisphere showed reduced cortical thickness in the ASD group compared with the TD group (Figure 1B) (cluster size = 1631.33 mm^2, Talairach coordinates: 11.5, 31.0, 17.4).
Conclusions: We identified sex-dependent cortical thickness alterations in ASD in the right occipital cortex, which may relate to sex differences in sensory processing in ASD. Sex-dependent cortical thinning was also observed in the anterior cingulate cortex. Both clusters were not reported in studies using ABIDE I data (Di and Biswal, 2016; Haar et al., 2014; Schaer et al., 2015). It may due to sampling variability, and suggests that there may be large heterogeneity in ASD samples. Further studies are needed to examine consistency and heterogeneity of results from ABIDE I and II.

37 **141.037** Brain Enlargement Persists through Adolescence in ASD, but Is Not Predicted By Clinical Severity

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Background: Converging evidence indicates that toddlers and early school age youth with Autism Spectrum Disorders (ASD) have larger brains than Typically Developing Controls (TDC). It remains unclear, however, if this enlargement persists beyond early development or whether there is later a period of arrested brain growth in ASD such that group differences disappear by adolescence or adulthood. Unfortunately, a majority of studies on this topic may be underpowered to detect the expected effects. Even well-powered studies are also often confounded by failure to match groups on characteristics correlated with brain volume (age, sex-ratio, and IQ). While toddlers with ASD have larger brains, there is limited evidence of a correlation between brain volume and ASD symptom severity. This is puzzling given reported group differences.
Objectives: We seek to determine, using a large, well-characterized single-site sample: 1) whether there is a persistent brain enlargement in ASD from childhood through early adulthood, and 2) whether volume difference is related to ASD severity.
Methods: Â A total of 477 individuals with (N=254) and without ASD (N=223) aged 6-25 (mean=13±3.79) completed a structural MRI study. The sample included a large number of females (N=102) and spanned a wide IQ range (47-158).Â This is perhaps the largest structural MRI study of ASD to date conducted with a single MRI scanner and sequence. High-resolution T1-weighted anatomical MRI images were examined for group differences in total brain, ventricular, gray, and white matter volumes. ASD severity was assessed with the Social Responsiveness Scale – 2 (SRS-2), the ADOS-2 calibrated severity score, and the Social Communication Questionnaire (SCQ).
Results: Â Total brain, gray, white, and ventricular volumes were larger in the ASD group (effects of diagnosis partial η2=0.06, 0.07, 0.03, and 0.04, respectively, all ps<0.001, between-group percent differences=2.7, 2.9, 2.4, and 19.5%), with no interactions between diagnosis and age or sex. However, there were significant interactions between diagnosis and IQ, such that normative positive correlations of IQ and brain volume are absent in ASD. When controlling for age, sex, and IQ, neither ADOS severity score, the SRS, nor the SCQ significantly predicted brain volume within the ASD group.
Conclusions: These results clarify our understanding of ASD brain size at different ages, showing that brain enlargement persists into adulthood. However, the magnitude of the ASD volumetric enlargements is greatest for those with lower IQs. The absence of volume by IQ correlations in ASD suggests that the cognitive advantages typically conferred by increased brain volume are absent in ASD. Importantly, the failure to find within-ASD correlations with disorder severity concurrent with the categorical between-group brain volume difference suggests that brain size enlargement might not be related to the core features of ASD per se, but rather is incidental to having ASD. This suggests that increased brain volume is not an underlying source of ASD phenotypic differences, which might instead be related to cortical microstructure or connectivity differences. Alternatively, the absence of a correlation between brain size and ASD severity might indicate that our putative severity metrics fail to capture important aspects of ASD heterogeneity.

38 **141.038** Brain Network Organization Correlates with Autistic Features in Preschoolers with Autism Spectrum Disorders and Their Fathers

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Background:
Autism Spectrum Disorders (ASD) are neurodevelopmental conditions characterized by an abnormal brain connectivity. Given its highly heritable origin, first-degree relatives could show a set of ''sub-threshold'' features resembling milder manifestations of ASD (broader autism phenotype –BAP). There is great interest in evaluating whether BAP characteristics extend also to neuroanatomical connectivity of first-degree relatives of ASD probands. A powerful tool for the investigation of this topic is Diffusion Tensor Imaging (DTI) technique that, for the first time, was used in parents of individuals of ASD.
Objectives:
We aimed to investigate the correlation of the structural brain network: (a) with the autistic traits in fathers and (b) with the severity of ASD in their probands. We recruited only fathers since, according to the literature, they generally have a higher probability of expressing BAP traits.
Methods:
16 ASD child-father dyads were recruited. Autism severity in children (all males, age: 1.5-5.2 y) was evaluated by ADOS calibrated severity score (ADOS-CSS). Autistic traits in fathers were assessed with the Autism-Spectrum Quotient (AQ). Structural parcellation was obtained. After pre-processing of DTI data, fiber orientation distribution was estimated using constrained spherical deconvolution. Anatomically-constrained tractography was obtained and number of streamlines weighted connectomes were generated. Global measures (global efficiency, transitivity, characteristic path length and small-world propensity) and local measures (local efficiency - EL - and clustering coefficient - CC) were computed. A general linear model was performed to evaluate correlations between network and clinical measures.
Results:
No significant correlations with global measures were found. In children, ADOS-CSS positively correlated with EL of left Paracentral Lobule (p=.019) and left Superior Temporal Gyrus (p=.037) and CC of left Cingulate Cortex (p=.02). In fathers, total AQ negatively correlated with CC of left Transverse temporal cortex (p=.04). "*Attention switching*" negatively correlated with EL and/or CC of bilateral Superior Frontal Gyrus (left: p=.15, p=.015; right: p=.007, p=.005), left Inferior Frontal Gyrus (p=.01; p=.01), bilateral Middle Frontal Gyrus (left: p=.038, p=.013; right: p=.009, p=.004), left Frontal Pole (CC: p=.04), left Orbitofrontal Cortex (p=.006, p=.01), left Lateral Occipital Cortex (p=.025, p=.008;), left Postcentral Gyrus (p=.032, p=.049), bilateral Cingulate Cortex (left: p=0.1, p=.015; right: p=.016, p=.016), right Supramarginal Gyrus (p=.038, p=.03), right Precuneus (p=.022, p.014), right Cuneus (p=.016, p=.026), right Superior Temporal Gyrus (CC: p=.027), right Inferior Temporal Gyrus (p=.039), and right Insula (p=.024, p=.034). "*Imagination*" negatively correlated with CC of Nucleus Accumbens (p=.02). "*Attention to details*" positively correlated with EL of left Inferior Frontal Gyrus and (p=.026) and "*communication"* with EL and CC of right Superior Frontal Gyrus (p=.024, p=.024).
Conclusions:
Significant correlations were found between local network measures and autism severity in ASD children and autistic traits in fathers. In fathers correlations were mostly negative indicating an association of that autistic phenotype with the decrease in local efficiency. Conversely, in ASD children all correlations were positive in line with the "early over-connectivity" theory of ASD. Interestingly, some regions of impairment overlap between the two groups suggesting an intergenarational transmission of neural substrates. Overall, these results may help elucidating the neurostrctural endophenotype of ASD.

39 **141.039** Cerebellar Volume in Autism: Meta-Analysis and Analysis of the Abide Cohort

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Background: Many reports suggest that cerebellar dysfunctions may be implicated in autism spectrum disorders (ASD). The cerebellum is a heavily folded region of the rombencephalon, with a number of neurons comparable to that of the neocortex. The cerebellum has been traditionally involved in the performance of precise motor behavior, but there is now evidence for its involvement in cognitive and affective functions as well.
Objectives: Our aim was to objectify a possible alteration of the cerebellar volume in ASD.
Methods: We looked for a difference of mean or variance between the cerebellar volume distributions of ASD and controls. We first performed a meta-analysis of the literature by looking for studies reporting cerebellar MRI volume measurement on ASD patients and typical controls. We used the PRISMA guidelines for the selection of articles. We combined the effect sizes using the random effects model. We also looked for possible factors of variability across studies by making a meta-regression on age and intelligence quotient (IQ). We then tried to replicate the results of the meta-analysis by analyzing the cerebellar volume segmented with FreeSurfer from the ABIDE cohort. We analyzed the effect of the variables group, site, age, IQ and sex on cerebellar volume by both a linear model approach and a meta-analysis approach.
Results:
Meta-analysis: 16 studies met the criteria for inclusion (635 patients and 424 controls). Although the studies were highly heterogeneous (I^2=72%, $p<0.0001$), we found a larger cerebellar volume in individuals with ASD compared with typical controls (Cohen's d=0.32, 95% confidence interval: [0.08; 0.56]; p=0.0089). Individually, the mean statistical power that the studies had to detect such an effect size was only 22.7%. We also found a significative negative impact of age on Cohen's d (-0.041 year-1, 95% confidence interval: [-0.065; -0.016]), suggesting a faster cerebellar volume decrease in individuals with ASD during adulthood. Age and IQ were not the only factors of heterogeneity between studies, as the residual heterogeneity was still statistically significant (I^2=49%, p=0.016) after covarying with these factors. We did not find a statistically significant difference in the variance between individuals with ASD and typical controls (combined log-variance ratio=0.19, 95% confidence interval: [-0.12; 0.50]). ABIDE: After quality control, 341 patients and 360 controls were retained. The mean cerebellar volume did not differ significantly between individuals with ASD and controls. There was a strong impact of the site on the measured volume. We were able to see evidences for effects of age IQ and sex on cerebellar volume, but none of the effects were statistically significantly different between groups.
Conclusions: The MRI analyses did not confirm the results of the meta-analysis. These discrepancies could be explained by a higher heterogeneity between the studies of the meta-analysis than in the sites of ABIDE, but could also result from methodological biases. Our results call into question the validity of results obtained from small, underpowered cohorts, and underline the utility of data sharing and collaborative work to obtain larger samples.

40 **141.040** Chandellier Cells Modify the Balance of Excitation / Inhibition in Autism

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Background: Â An interneuron alteration has been proposed as a source for the modified balance of excitation / inhibition in the cerebral cortex in autism. We previously demonstrated a decreased number of parvalbumin (PV)-expressing interneurons in prefrontal cortex in autism. Our most recent data indicates that a specific type of PV-expressing neuron is altered in autism, the Chandellier (Ch) cell. Chandellier cells are interneurons that generate fast-spiking action potentials and synchronize the activity of numerous pyramidal cells through rhythmic inhibition. Chandellier cells innervate the axon initial segment of pyramidal cells – in contrast to the rest of interneuron input that takes place on dendrites. As a consequence, the loss of small numbers of Ch cells could critically alter pyramidal neuron output and impair cerebral cortex function.
Objectives: Â As discussed in our previous publication investigating PV+ interneurons in the autistic neocortex (Hashemi et al., 2016), the decreased number of PV+ Ch cells we detected in in autism may represent an actual decrease in cell number, on the other hand it may represent an apparent decrease in cell number resulting from reduced PV protein levels in Ch cells. To determine if the number of Ch cells, rather that the expression of PV by Ch cells, is altered in autism, we quantified Ch cartridges in autism and control tissue. If the number of Ch cells is decreased we also expect to find a decrease in the number of Ch cartridges.
Methods: We collected prefrontal BA9, BA46, and BA47 in samples obtained from 10 autism, 10 autism with seizure, and 10 control age-matched cases. The tissue was obtained from the Autism Tissue Program (ATP), currently known as Autism BrainNet, and the UC Davis Medical Center. We cut the tissue and performed immunostaining for GAT1 that clearly labels cartridges. We quantified the number of cartridges in 3 mm wide sections of cortex, and statistically compared data between groups.
Results: Our preliminary data indicate that in area BA 46 there is a decrease in the number of GAT1-cartriges in the autism and the autism with seizure groups when compare to the control group.
Conclusions: Here we demonstrated that both Ch cells and also their terminal axons, the Ch cartridges, are numerically decreased in autism. A decrease in the number of Ch cells could result from different factors including 1) decreased production of Ch cells by precursor cells during prenatal development, 2) increased cell death among Ch cells during development, or 3) altered migration of Ch cells to their final destination in the cerebral cortex. This finding expand our understanding of GABAergic system functioning in the human cerebral cortex in autism, which will impact translational research directed towards providing better treatment paradigms for individuals with autism.

41 **141.041** Changes in Local Gyrification Index Across Childhood and Adolescence in Autism Spectrum Disorder (ASD)

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Background:
A large body of evidence from volumetric MRI supports an atypical trajectory of early cerebral overgrowth in Autism Spectrum Disorder (ASD) followed by abnormally slow growth. Comparatively few studies have examined local patterns of gyrification, and the relationship between gyrification and measures of cortical thickness (CT) and surface area (SA) remains poorly understood. Developmentally, gyrification is thought to be influenced by mechanical forces resulting from differential rates of early cortical expansion (radial and tangential expansion, differences in laminar expansion). Atypical gyrification patterns may therefore reflect the timing of brain growth abnormalities in ASD and elucidate the history of early developmental disturbances.
Objectives:
In an earlier study, we found that the local gyrification index (lGI) decreased with age more rapidly in an ASD than a TD comparison group. The current study sought (1) to replicate these findings in an independent sample, and (2) to investigate the relationships between CT, SA, and lGI.
Methods:
T1 weighted MRI sequences (1mm^3) were downloaded from the Autism Brain Imaging Data Exchange for 137 right-handed males aged 7–18 years (60 ASD, 77 TD; all from New York University). FreeSurfer (v5.3.0) was used to obtain measures of CT, SA, and lGI. Following quality assurance and group matching on age and non-verbal IQ, 31 ASD and 31 typically developing (TD) participants were included in analyses. A general linear model was used with group and age (continuous) as predictors and Social Responsiveness Scale (SRS) scores as a correlate. Correction for multiple comparisons used Monte Carlo null-z simulations.
Results:
For lGI, significant diagnosis-by-age interactions were found bilaterally in rostral middle frontal gyrus, in left inferior frontal gyrus (pars triangularis), and in right precuneus. Whereas lGI was relatively stable across age in the TD group, the ASD group exhibited a significantly greater negative slope (decreasing lGI with age). A main effect of group (ASD<TD) was also found in left medial orbitofrontal and right inferior parietal clusters. For CT, a significant group effect (ASD>TD) was found in a left lateral occipital cluster. No significant effects were observed for SA. Correlation analyses in the ASD group revealed that greater social impairment (higher total SRS) was associated with lower lGI bilaterally in fusiform clusters, after controlling for age.
Conclusions:
Declining lGI with age is often reported in typical adolescence, and here, regions of steeper age-related decrease were observed in ASD compared to TD participants in frontal and parietal lobes. A similar interaction was found in our earlier study on an independent sample, in partially overlapping cortical regions, largely within the frontal lobe. Together, these findings indicate an atypical developmental trajectory for frontal lGI in ASD. Correlations between fusiform lGI and SRS add additional support to the functional relevance of this morphometric measure. Further comparisons will be presented to directly assess associations between lGI, CT, and SA in larger samples.

42 **141.042** Cortical Thickness and ASD in 22q11.2 Deletion Syndrome; An International Collaboration

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Background: Individuals with syndromic forms of autism spectrum disorder (ASD) provide a unique opportunity to understand specific genetic risk mechanisms.Â For example, individuals with 22q11.2 Deletion Syndrome (22q11DS) are at significant risk (30–50%) of developing ASD (Schneider et al., 2014). The neurobiological mechanisms contributing to this increased risk are unknown – but likely include genetically determined differences in particular developmental pathways. We and others previously reported that individuals with ASD have significant differences in cortical thickness (CT) (e.g. (Ecker et al., 2013). CT is important because it results from distinct neurodevelopmental pathways and is a proxy measure of dendritic arborization and pruning.
Objectives: We wished to establish whether variation in CT is associated with comorbid ASD in 22q11DS individuals.
Methods: We included 73 individuals with 22q11DS (23 males and 34 females), aged between 6 and 33 years (mean age=14, SD=6). Of these, 36 individuals met diagnostic criteria for ASD based on the ADI-R & ADOS. The resulting two groups (i.e. 22q11DS+ASD & 22q11DS-ASD) did not differ significantly on age or IQ. Participants underwent structural T1-weighted magnetic resonance imaging (MRI) at the Institute of Psychiatry, Psychology and Neuroscience, London & The Semel Institute for Neuroscience, UCLA. CT was measured using FreeSurfer (http://surfer.nmr.mgh.harvard.edu). Vertex-wise statistical analysis of CT measures were estimated by regression of a GLM including group as categorical fixed effect factor. A random-field-based cluster-threshold (p<0.05) was applied to correct for multiple comparisons (Worsley 1999).
Results: Individuals with 22q11DS+ASD, when compared to 22q11DS-ASD, had significantly increased cortical grey matter thickness in 2 right hemisphere brain areas; the inferior frontal gyrus (BA47) & postcentral gyrus (BA43)(Fig. 1).
Conclusions: This is the first known study to indicate that absence or presence of comorbid ASD is associated with genetically determined variation in cortical morphometry. Future research is required to determine how genetic variation within the deleted region determines outcome.

43 **141.043** Cross-Disorder Comparison of Idiopathic Autism, Fragile X, Angelman Syndrome, and Typical Development: An MRI and DTI Study of Brain Structure

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Background: Brain abnormalities are common in autism and related neurodevelopmental disorders, but no study has directly compared the brain structure of children with idiopathic autism, Angelman syndrome, Fragile X, and typical development.
Objectives: We conducted an MRI and diffusion tensor imaging (DTI) study of school-age children with related neurodevelopmental disorders to determine the extent and specificity of neural alterations and their associations with clinical symptoms.
Methods: Participants were n=11 children with Angelman syndrome (AS; 5 female), n=19 with Fragile X syndrome (FXS; all male), n=31 with autism spectrum disorder (ASD; 1 female), and n=31 age-matched typically developing controls (TD; 3 female). MRIs were conducted at 4-12 years of age, including T1- and T2-weighted ($1mm^3$ voxels) and diffusion-weighted scans ($2mm^3$ voxels; 45 directions). Tissue segmentation yielded cerebral white matter (WM), grey matter (GM), and total cerebral volume (TCV=WM+GM). Diffusion tensor tractography of specific fiber tracts yielded fractional anisotropy (FA), axial diffusivity (AD), and radial diffusivity (RD). Analysis of covariance tested for group differences in dependent variables (WM, GM, TCV, DTI measures) while accounting for differences in age and sex; hierarchical multiple regression tested associations between fiber tracts of interest and behavioral data, while testing for effects of age and sex.
Results: There was a significant main effect of group on WM volume ($F_{3,87}$=21.74, p<.0001), with the AS group having significantly smaller WM volume compared to all other groups (p<.0001), and the FXS group having significantly larger WM volume compared to all other groups (p<.05) (**Fig. 1**). There was a significant main effect of group on GM volume ($F_{3,87}$=17.75, p<.0001), with the AS group having significantly smaller GM (p<.0001), but there were no significant differences between the other groups. The AS group had significantly smaller TCV ($F_{3,87}$=22.36, p<.0001). **Figure 1** illustrates the least-squares means, adjusted for age and sex. The AS group showed a disproportionate reduction in WM volume (32% smaller vs. TD group) compared to GM volume (18% smaller vs. TD group).
Following this finding of WM reduction in children with Angelman syndrome, tractography was performed in several WM tracts including the corpus callosum, corticospinal tract, and corticothalamic tracts. In each of these tracts, the AS group showed significantly lower FA (p<.0001) and higher RD (p<.0001) compared to TD controls. In the AS group, higher RD in these motor tracts was significantly associated with poorer motor ability (r=-.58, p<.05) (**Fig. 2**).
Conclusions: Differences in white matter are evident in monogenic syndromes such as Angelman syndrome and Fragile X, even using coarse measures such as overall WM volume. However, more detailed attempts must be made to tease apart the heterogeneity of idiopathic autism. DTI, for example, has been previously shown to identify connectivity alterations associated with specific clinical symptoms in ASD and FXS, and here we show associations between corticospinal connectivity and motor ability in Angelman syndrome, a disorder marked by pervasive and disabling motor deficits. DTI analyses of the ASD and FXS group are underway and will be presented along with associations with repetitive behaviors, anxiety measures, and social and communicative ability.

44 **141.044** Developing White Matter Microstructure Networks in Autism Spectrum Disorders

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Background: Brain imaging findings in children with autism spectrum disorder (ASD) suggest the disorder is associated with altered brain development and disrupted structural and functional brain "connectivity." Thus, while white matter microstructure is fundamental to such brain connectivity, developmental disruptions to networks of white matter may provide a core neurobiological feature of ASD. Diffusion tensor imaging (DTI) is an integral neuroimaging technique to assess the white matter microstructure and has been influential to the study of white matter alterations in ASD. However, while vast white matter differences have been reported to exist in ASD, these differences are often reported at the regional level. Thus, information can only be gleaned in regards to the evaluated region of interest. As distinct white matter regions work harmoniously with others, a more informative approach may be to study the patterns and characteristics of white matter networks in ASD.
Objectives: We utilized a data-driven technique to identify underlying white matter networks in a large sample of ASD individuals and subsequently characterized the developmental trajectories of these white matter networks.
Methods: Participants for this study consisted of 100 males with ASD between 3 and 39 years of age. DTI data were acquired from each participant, images were corrected for distortion and head motion and maps of fractional anisotropy (FA), were calculated. Diffusion tensors were spatially aligned to a study-specific template and the resulting transformations were used to bring each individual's FA map into spatial alignment. Spatially aligned FA maps were subsequently smoothed with a 5mm full-width-at-half-maximum kernel and concatenated into a single 4D image file. Spatial independent component analysis (sICA) was then performed using the MELODIC tool (http://fsl.fmrib.ox.ac.uk/fsl/fslwiki/MELODIC), providing spatially independent networks. Trajectories of these networks were examined using mixed-effects models using R.
Results: A total of 57 spatially independent networks were found to exist, though 11 of these were observed to be associated with artifacts (errors resulting from image misregistration or motion). The remaining 46 components were visually assessed to correspond to biologically plausible bilateral and unilateral white matter regions spanning both individual and multiple white matter tracts. Mixed effects modeling of FA from these networks show that FA significantly (p<0.05, Bonferroni corrected) changes across the examined age range, while the timing of age-related changes are distinct among the different networks.
Conclusions: Our results suggest that measures derived from diffusion imaging combined with data-driven analysis techniques, such as sICA, may be used to parcellate the brain into biologically meaningful networks. Future analyses will examine whether the developmental trajectories of these white matter networks relate to the autism severity measures. We will additionally compare the developmental patterns from these distinct networks to those estimated from individuals with typical development.

45 **141.045** Diffusion Tensor Imaging in Unaffected Siblings of Individuals with Autism: A Pilot Study Using Tract-Based Spatial Statistics

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Background: Numerous studies have been published using diffusion tensor imaging (DTI) to demonstrate white matter abnormalities in autism spectrum disorder (ASD). However, very few studies assess whether white matter abnormalities exist in unaffected siblings (UAS) of those with ASD. Among those published, including a recent report from the authors of this abstract, samples of modest size included both boys and girls in the same analysis. Consequently, findings may be influenced by the structural variability associated with gender. To address this limitation, the authors compare newly-recruited male UAS with stringently-matched control participants.
Objectives: To evaluate whether previously reported intermediate neuroendophenotypes in mixed-gender samples of UAS can be replicated in a new male-only group of participants, who were individually matched to typically developing males on age and IQ.
Methods: Participants included 12 pediatric male UAS (age in months: M = 129.99, SD = 41.68, Range = 64.9-203.8; Full-scale IQ: M = 112.92, SD = 11.21, Range = 96-135) and 12 pediatric male control participants (age in months: M = 132.47, SD = 45.7, Range = 62.9-197.57; Full-scale IQ: M = 109.83, SD = 14.62, Range = 89-141).Â T1-weighted and diffusion-weighted MRI (directions = 30 and b0 = 5) were acquired using a 3-Tesla scanner.Â FMRIB Software Library (FSL) was used to process/analyze diffusion-weighted data and compute the following WM microstructure metrics: fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD) and radial diffusivity (RD).Â Voxel-wise analysis of multi-subject diffusion data was conducted using FSL's Tract Based Spatial Statistics (TBSS). Areas of significant difference were computed using Threshold-Free Cluster Enhancement (TFCE) and displayed as p-value images, where $p < 0.05$ corrected for multiple comparisons across space.
Results: Â There were no statistically significant differences in age [$t(22) = 0.14$, $p = 0.89$] or IQ [$t(22) = -0.58$, $p = 0.57$]. There were no statistically significant group differences in FA, MD, AD, or RD when UAS were compared to control participants. Trends toward statistical significance were also not observed in comparison of the aforementioned WM microstructure metrics.
Conclusions: Unlike previous mixed-gender comparisons between UAS and control participants, this preliminary male-only comparison does not support the presence of an intermediate neuroendophenotype in male UAS. Lack of statistically significant differences in the UAS and control comparison does not preclude that aberrant WM microstructure exists in UAS males, especially if the effects are small. Future studies should investigate whether current findings replicate in larger studies with closely-matched comparison groups.

46 **141.046** Examination of Anterior-Posterior Connectivity in Children with Autism Spectrum Disorder

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Background: It has been hypothesized that the heterogeneous phenotype of Autism Spectrum Disorders (ASD) could implicate a greater likelihood of abnormalities in the connectivity between different neural networks rather than localized alterations. In particular, previous studies have provided evidence of underconnectivity in ASD, with particular respect to reduced long-range connectivity between frontal lobes and posterior brain regions (Just et al., 2004, Villalobos et al., 2005, Mostofsky et al., 2009). Structural connectivity can be effectively assessed in vivo using magnetic resonance techniques like diffusion tensor imaging (DTI). Exploring the hypothesis of an anterior-posterior underconnectivity in ASD might provide useful insight into the mechanisms of social communication, given the key role of these pathways for language, praxis, and imitation.
Objectives: To investigate whether a well-characterized group of high-functioning children with ASD would demonstrate reduced white matter integrity, denoted by reduced FA and increased MD, in inferior fronto-occipital fasciculus (IFOF), inferior and superior longitudinal fasciculus (ILF and SLF, respectively). On the basis of established findings for impairments in language and praxis in ASD, we further hypothesized that the findings would be more prominent in the left hemisphere.
Methods: Fifty-two children with ASD, ages 8 through 12 years, and fifty-four typically developing (TD) controls matched by sex, age, and intellectual reasoning ability participated to the study. DTI images were acquired with a single-shot, echo-planar diffusion-weighted sequence. Two runs were collected in each subject, with 32 gradient directions (b = 700 s/mm3) and one b0 in each run. Sixty 2.2-mm axial slices were acquired for each volume, with 0.8 mm in-plane reconstructed resolution. DTI data were analyzed using Automated Fiber Quantification toolbox, which employs deterministic fiber tracking for quantifying diffusion profiles along ten nodes for each reconstructed white matter tract. Diagnostic effects on fractional anisotropy (FA) and mean diffusivity (MD) were assessed using independent t-tests for each white matter tract.
Results: Â Analyses revealed that TD children exhibited higher FA in nodes along the posterior portion of the left ILF, and the anterior segment of the right ILF (all $p<0.05$). In children with ASD, higher mean diffusivity was observed in distinct nodes along the reconstructed fiber tracts (all $p<0.05$), with the left SLF showing a significant group difference in 5 out of 10 nodes (see Fig. 1). Overall, most of the group differences were lateralized in the left hemisphere.
Conclusions: Â The present study provides evidence for alterations in diffusion along a set of major anterior-posterior fiber tracts in children with ASD. In particular, our main finding is a consistently increased diffusivity in the left SLF in children with ASD. The SLF has been known to play a role in motor functions and other "higher" functions, including language and working memory. Accordingly, consistent with our hypothesis, our findings indicate a pattern of left-lateralized white matter abnormalities. Possible extension of the present work should investigate the relationship between localized differences in diffusion properties and core features of ASD, as well as measures of language, imitation, and motor function.

47 **141.047** Head Circumference and Brain Volume Trends in Autism Spectrum Disorder

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Background: Head circumference (HC) and total brain volume (TBV) studies have consistently concluded Autism Spectrum Disorder (ASD) diagnosis to influence head size and TBV, respectively. Yet because HC and TBV findings are usually based upon small to moderate samples, the clarity of the overall picture is lost.
Objectives: To address this issue, an atlas of HC and TBV studies has been developed, based upon and comparing studies within ASD against each other, and against studies of typically developing (TD) individuals. It was hypothesised that HC and TBV would both be enhanced by ASD diagnosis.
Methods: Criteria for inclusion in to the atlas necessitated that the authors had provided raw data, or that it could be obtained from a publication using data capture techniques (Data Thief v.III; http://www.datathief.org; Tummers, 2006). Alternatively, where only means, SDs, and sample sizes were reported, we statistically modelled the data in two ways. First, we model the data with the mean value weighted by the sample size. In a second analysis, we statistically inferred a random sample within 1 SD of the reported mean for either or both age and HC or TBV of the participant. Additionally, ANCOVA's were performed on the raw HC and TBV data, controlling for age.
Results: Nineteen HC studies (N=3,051) and 22 TBV studies (N=1,210) of participants with ASD were obtained. Twelve HC studies and 19 TBV studies of TD individuals (N=1,434) were also included. Ages ranged from 0 to 51 years. Results found loglinear fits to account for the most variance in the HC data, and second order polynomial fits to be most appropriate for TBV data. As hypothesised, ANCOVA's highlighted HC, between ages 0 and 4 years, to be greater in individuals with ASD compared to TD participants. Furthermore, TBV was larger in those with ASD compared to TD individuals between ages 1 to 4 years, 5 to 12 years, and 19 years and above. However, no significant difference in TBV was found in individuals between 13 and 18 years of age.
Conclusions: The present study supports the position that ASD diagnosis influences HC and TBV. This is the first instance where this amount of data has been collected and while examining the variance in the data, establishing the trend of HC and TBV across a substantial range of age. Nonetheless, it is apparent that the publication of raw data in the literature would be of great assistance in future evaluations of this issue.

48 **141.048** Increased Global Covariance of Cortical Volume in Children with ASD

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Background: Structural covariance (SC) is the correlation between structural brain features and this metric may reflect long-term developmental influences, the effect of plasticity and mutual trophic influences [1, 2]. Regions with high SC often belong to brain systems such as salience or default mode networks [3] which serve specific functions [4]. By examining SC in ASD it may be possible to determine which regions are developmentally linked and further our understanding of brain development in this disorder
Objectives: Â We aim to examine global patterns of cortical volume SC in ASD and typically developing controls (TDC) in both children (age 7–13 years) and adolescents (age 13–18 years). We aim to: 1) characterize global patterns of cortical SC in ASD and TDC 2) determine if differences in SC exist between ASD and TDC and 3) whether changes in SC occur with age.
Methods: Structural MRIs and demographic information were obtained from ABIDE [5]. We investigate SC in a cohort of right handed male subjects which consists of 64 ASD (average age ± std: 10.88 ± 1.45 years) and 75 TDC (10.67 ± 1.35 years) children and 63 ASD (15.34 ± 1.58 years) and 61 TDC (15.49 ± 1.43 years) adolescents. MRIs were preprocessed and cortical volumes were computed using FreeSurfer [6]. SC was calculated using Pearson's correlation between the 34 cortical volumes listed in Table 1 and this resulted in 2,278 pairs of inter and intra hemispheric SCs. Significant SC differences were determined between ASD and TDC for children and adolescents separately. Permutation testing was performed ($N = 10^6$) to verify results.
Results: Â Results indicate inter and intra hemispheric SC differences in ASD children and that children with ASD have higher SC than TDC for most pairs (87%) of brain regions. In adolescents this difference was not present. The median SC were as follows: ASD children: 0.59, TDC children: 0.42, ASD adolescents: 0.39 and TDC adolescents: 0.39. Highly significant ASD vs. TDC SC differences were found in children (Figure 1A) but differences were not significant in adolescents (Figure 1B) after correction for multiple comparisons. Permutation testing further validated the above result. SC pairs containing left entorhinal cortex with left rostral anterior cingulate, left fusiform, right medial orbitofrontal, and right fusiform survived Bonferroni correction ($P<2.2x10^{-5}$) in children.
Conclusions: Many of the SC pairs that survived multiple comparisons correction in children have been implicated previously in ASD. Regions such as the right fusiform and medial orbitofrontal gyri are part of the face processing network[7] and the anterior cingulate has been implicated in social impairment[8]. This study raises the possibility that SC between the left entorhinal cortex, which plays a role in memory[9], and the above regions may underlie social impairment in ASD. We report altered cortical topography (both inter and intra) in children with ASD that normalizes during development in adolescence. To our knowledge this study is the first to characterize global cortical SC differences in ASD.

49 **141.049** Mapping Developmental Trajectories of Brain White Matter from Birth to Six Months Using Diffusion Tensor Imaging: A Preliminary Study

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Background: Research on brain development may provide groundbreaking insights into the identification of brain systems that underlie the development of social cognitive functions(Johnson,2005) and developmental disabilities, such Autism Spectrum Disorder (ASD)(Wolff, 2013). Diffusion tensor imaging (DTI) quantifies brain white matter microstructures and has become a prominent tool for indexing white matter development(Basser,1995).
Objectives: To reveal critical transitions in regional brain development in typically developing infants from birth to 6 months as a benchmark against which to compare atypical transitions of brain development that may be a sign or symptom of ASD.
Methods: 24 typical developing infants (mean age: 115 days (27-218 days); 6 females) were enrolled. DTI data were collected from each infant at three pseudorandom time points between birth and 6 months, yielding a total of 53 scans. Data were collected on a 3T Siemens Trio scanner with 32-channel head coil and multiband sequence(Moeller, 2010). DTI parameters are: TR/TE of 6200/74ms, a multiband factor of 2 combined with a GRAPPA of 2, FOV of 184×184, spatial resolution of 2mm isotropic, b=0/700 s/mm2, 61 diffusion directions, extra 6 of b0s in both phase encoding directions. Distortion corrected(Andersson, 2003)Â brain tensor maps from each participant were aligned to a sample-specific common space using tensor-based registration(Zhang, 2006). The John Hopkin's Neonate Atlas(Oishi, 2011) was aligned to our common space, grouped into nine brain areas and multiplied with a white matter mask (mean fractional anisotropy, FA>0.25) (**Fig.1A**). Principal Component Analysis through Conditional Expectation (PACE)(Yao, 2005)—a method designed to overcome missing values, a common problem in longitudinal infant research—was used to fit changes in FA and its derivatives over time in each brain area.
Results: Â FA increases in all brain areas from birth to 6 months (**Fig.1B**), with subcortical, cerebellum and occipital lobes having the highest FA increase during infants' first 6 months. FA change rates decrease over time (**Fig.1C**), with orbitofrontal areas showing the highest FA change rate (although its FA value is lower relative to other brain regions at birth). By month 6, rate of change in FA decreases by approximately 8.6 fold. All brain regions show negative FA accelerations at birth, especially in cortical areas, followed by a rapid decrease in acceleration toward zero. Interestingly, FA accelerations reach a plateau around 5 months of age in most cortical regions.
Conclusions: Â We identified a potential critical time period around 5 months of age, in which FA accelerations reach a plateau for the majority of brain regions. Although the exact causes of this plateau are still under investigation, possible explanations include pruning processes(LaMantia, 1990), divergent trends of FA changes in white and gray matter, and/or the development of association pathways(Dubois, 2014). This work highlights the importance of using non-parametric curve fitting techniques, such as PACE, for modeling data and their derivatives, as approaches that specify the shape of brain developmental profiles a priori may miss critical dynamic information in brain development, especially in early infancy.

50 **141.050** Motor System Integrity in Older Adults with Autism Spectrum Disorder

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Background: Gait disturbance, clumsiness, and other mild movement problems are often observed in persons with autism spectrum disorder (ASD; Maurer, 1982). This study focused on brain differences that may indicate the neural basis for these motor symptoms which are common, although not ubiquitous, among individuals with ASD.
Objectives: Using magnetic resonance imaging (MRI), we examined cortical and white matter integrity in brain regions associated with motor function (motor cortex, cerebellum, basal ganglia) in a cross-sectional study comparing middle-aged (40-65 years) adults with ASD and age-matched typically developing (TD) controls. We hypothesized gray matter and white matter tracts associated with motor functioning would be smaller in middle-aged adults with ASD, as compared to TD controls. We also expected to observe reduced motor performance (slower finger tapping speed) in the ASD group as compared to their TD counterparts.
Methods: Thirteen right-handed men with ASD (Age: 49.2 (7.3); Education: 14.9 (2.7); IQ: 109.5 (14.5)) and 17 matched-TD men (Age: 49.4 (6.9); Education: 15.8 (2.6); IQ: 110.1 (11.1)) were recruited. Motor performance was measured using a finger tapping task. 3D T1 structural and diffusion tensor images were obtained using a Philips 3T scanner. FreeSurfer was used to determine gray and white matter volumes. White matter integrity was assessed via fractional anisotropy (FA), masked with each person's white matter map via voxel based morphometry in SPM8.
Results: Â The mean number of right finger taps in the allotted time was less in the ASD (47.2 (13.0)) group compared to TDs (51.6 (7.0)), but was not statistically significant. However, this is likely due to the much greater degree of variability in the ASD group compared to controls. This finding was also observed for the left finger tapping. The ASD group had smaller white matter volume for bilateral cerebellum (left; p=0.05, right; p=0.04), and brainstem white matter volume (p=0.04) compared to the TD group. There were no significant differences between ASD and TD participants for cortical or subcortical (gray matter) volume.
Conclusions: Smaller cerebellar white matter volume may account for the slower motor differences observed in older adults with ASD. Previous studies have found anatomical differences in the cerebella of younger ASD subjects (Courchesne et al., 2001), consistent with our findings of cerebellar differences. This cross-sectional study aims to extend those findings to aging adults. Interestingly, finger tapping speed was extremely variable among the ASDs, and it is possible that other factors beyond the structures examined here play a role in sustained fine motor movements.

51 **141.051** Multimodal Non-Sedated MRI during an RCT of Simvastatin in Neurofibromatosis Type 1 (NF1)-Syndromic Autism.

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Background: Understanding neurochemical and physiological dysregulation is thought to have potential as a basis to model developmental abnormalities in autism. The most common non-invasive technique used to acquire measures of both anatomical, neurochemical and physiological parameters in the developing brain is multi-modal Magnetic Resonance Imaging (MRI). Simvastatin is an HMG-CoA reductase inhibitor.
Objectives: To assess the feasibility and results of multi-modal MRI assessment of a range of neurochemical and neuro-physiological measures in non-sedated, awake children with Neurofibromatosis Type 1 (NF1) syndromic autism undergoing an early phase trial of Simvastatin intervention.
Methods: The patient cohort was acclimatised to awake MRI scanning using a social story and two weeks of exposure to mp3 recordings of specific MRI scan sequence noises at specified time points during the day when awake and during sleep preparation. Scanning was performed at baseline, then following twelve weeks of simvastatin or placebo exposure.
We measured the concentration of GABA and other neuro-metabolites in the left frontal white matter and deep grey nuclei using a single-voxel MEGA-PRESS sequence. We also acquired anatomical data using a whole brain gradient echo T1 volume acquisition with voxel size of 0.9mm^3. Brain perfusion measures were assessed using arterial spin labelling (ASL), whilst six-directional diffusion tensor imaging (DTI) was used to determine regional apparent diffusion coefficient (ADC) and regional fractional anisotropy. MEGA-PRESS data were analysed with the jMRUI v.5 software; the AMARES routine, was used to calculate metabolite concentration with tissue percentages extracted from a participant's T1 images for partial volume correction.
Results: In total 31 children presented for imaging, with 26 completing both baseline and week twelve imaging assessments (mean age 7.9, range 4.6-10.4). Absolute measures of GABA in the frontal white matter were seen to significantly increase in the treatment group (p=0.02) compared to the placebo group. Analysis for measure of change also identified significance at the 5% level in ASL perfusion in the ventral diencephalon and ADC in the cingulate gyrus in the treatment group, again not seen in controls. Finally there was significance in the interval change in glutamine + glutamate in the deep grey nuclei (p<0.05) again in the treatment group and not in the control cohort.
Conclusions: We have demonstrated that in this age group, made more challenging by the diagnosis of autism, careful patient preparation can result in successful multi-modal MRI assessment of both neuro-chemistry as well as physiological imaging in the awake patient. This is important as the effects of anaesthesia or sedation on the brain will impact on multi-modal imaging findings in such studies.
We have shown significant GABA changes after simvastatin exposure in this age group of NF1 autism. We also present the specific neurochemistry, perfusion and diffusion changes seen in these children indicative of measurable brain physiology changes after twelve weeks of treatment. These changes may be used to illuminate the pathogenesis of autism in this cohort, as well as being used as biomarkers for future phamaco-intervention studies.

52 **141.052** Sex Differences in Subcortical Morphometry of Children with ASD

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Background: ASD is associated with impairments in social, goal-directed, and motor function. Subcortical structures contribute to the control of motor and social functions, including networks of communication, emotion, and reward. Due to the underrepresentation of girls in anatomical studies of autism, there is a paucity of literature exploring neuroanatomical correlates of sex-based differences in children with ASD.
Objectives: We compared the volumes and morphology of subcortical structures in ASD boys and girls to those of their typically-developing peers. We were particularly interested in examining how sex differentially affects the volumes and morphology of subcortical structures of ASD compared to TD populations. We examined differences in the left and right caudate, putamen, globus pallidus, and thalamus.
Methods: T1-weighted MPRAGE images were acquired from 107 children with ASD (20 girls) and 107 typically-developing children (19 girls). Subcortical parcellations were performed using MRICloud, a high-throughput neuroinformatics platform for automated brain MRI segmentation. Univariate ANCOVA tests were performed on the volumes of each structure, with the between-subject factor of diagnostic group and covariates of age, total cerebral volume (TCV), and head coil type. P-values were FDR-corrected. LDDMM was used to examine morphological features of the subcortical structures.Â Diagnostic effects were tested using a linear regression model including age, TCV and head coil as covariates. Non-parametric permutation testing was used to obtain corrected p-values for each vertex on a shape's surface. Partial correlations were conducted to assess associations between subcortical volumes and behavioral measures of motor and social function and autism symptom severity. Age, TCV, and head coil were used as covariates
Results: Â ANCOVA revealed that girls with ASD showed larger right caudate and right thalamus volumes compared to TD girls (p=0.012, d = 0.872; p=0.012, d = 0.873). No volume differences were observed in boys. No sex-by-diagnosis interactions on subcortical volumes were found. Correlations between subcortical volumes and ADOS scores were found predominantly in ASD girls. In ASD girls, higher ADOS total scores correlated with larger left caudate volumes (p =0.017, r=0.586). Higher ADOS Communication+Social Interaction scores correlated with larger left caudate, left putamen, and right putamen volumes in ASD girls (p=0.0008, r=0.638; p=0.014; r=0.601; p=0.017, r=0.585). No volume correlations with ADOS were found in ASD boys.
Linear regression revealed the effect of diagnosis on subcortical shape, including localized expansion on the right putamen and right thalamus for children with ASD compared to TD children in the whole group (19/553 vertices; 7/605 vertices). Within ASD girls, we observed expansions in the right putamen and right globus pallidus compared to TD girls (2/512 vertices; 5/234 vertices). Within ASD boys, we observed expansions in the right putamen and left globus pallidus compared to TD boys (3/525 vertices; 3/250 vertices).
Conclusions: Our volumetric findings indicate that girls with ASD display more robust differences within same-sex peers than boys with ASD. An increased sample size of girls may facilitate our understanding of the relationship between sex and diagnosis in subcortical structures. Additional analysis will include examining shape correlations with measures of ASD symptomology, and motor and social function.

53 **141.053** Stereological Study of the Superior Temporal Gyrus in ASD

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Background:
The superior temporal gyrus (STG) is a polysensory region that processes and integrates complex information from the auditory, somatosensory and visual cortices and is thus implicated in complex and social and linguistic functions. Since social communication deficiencies lie at the core of autism spectrum disorder (ASD), the STG is a prominent region of interest to investigate the etiology of this disorder. Magnetic resonance imaging (MRI) studies have demonstrated that cortical growth of the temporal lobe deviates substantially in children with ASD compared to TD controls (Schumann et al. 2010) and at the genetic level, microRNAs are differentially expressed in ASD and TD cases (Ander et al., 2015).
Objectives:
This study builds upon prior MRI findings, and moves towards elucidating the cellular underpinnings responsible for aberrant brain development in this region. Here we estimate neuron number and size in the supra- and infra-granular cell layers of the STG in TD and ASD cases using comprehensive stereological parameters.
Methods:
Sixteen postmortem histological samples were assembled from the Autism Celloidin Library (ACL), comprising of 8 typically developing and 8 ASD cases (age, sex and hemisphere matched, ASD cases diagnosed using the Autism Diagnostic Interview–revised ADI-R). Celloidin-embedded hemispheres were cut at 200µm, 300 µm or 600 µm and stained with gallocyanin (Wegiel et al., 2014). STG boundaries were traced in accordance with Barger et al, (2015) using StereoInvestigator software (MBF Biosciences), and delineated into supra- (layers II-III) and infra-granular (layer V-VI) regions. The optical fractionator and nucleator modules of StereoInvestigator were used to estimate neuron number and cell volumes, respectively. Neurons were marked as pyramidal or non-pyramidal and the somal volume of every fifth neuron was recorded.
Results:
In an preliminary analysis of a small subset (6 TD and 6 ASD cases, aged 7-48 years old) of the full case list, we have found a comparable number of pyramidal and non-pyramidal neurons in the supra and infra-granular regions of the STG in TD and ASD cases, however pyramidal neurons across both regions were found to be 20% larger in ASD than in TD cases.
Conclusions:
Greater somal volume of neurons in the ASD cases could explain the enlargement of the STG observed with MRI studies. However, prior postmortem studies of a similar nature, some with an overlapping sample population used here, have reported smaller somal volumes in subcortical brain regions in ASD cases versus TD controls. Together these data highlight that ASD pathology varies by region, age and cell type and warrants further detailed cellular studies to truly understand the etiology of ASD.

54 **141.054** The Impacts of Dysregulation on Cortical Thickness, Surface Area and Gyrfication for Males with and without Autism Spectrum Disorders

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Background: Although dysregulation, involving impairments in affective, behavioral and cognitive control, is common in autism spectrum disorder (ASD), the neural mechanism of dysregulation in ASD remains elusive. For typically developing (TD) individuals, several brain regions, such as anterior cingulate cortex, dorsolateral prefrontal cortex, ventromedial prefrontal cortex and amygdala, is involved in dysregulation. Interestingly, most of these regions overlap with those implicated in pathophysiology of ASD, warranting further investigations.
Objectives: To test effects of dysregulation on neuroanatomy in ASD, and to investigate neurostructural correlates of dysregulation in ASD.
Methods: Surface-based morphometry using FreeSurfer was applied on structural MRI images from 85 males with ASD (ranging 7-17 years, mean=12.9, standard deviation, SD=2.3) and 65 TD (mean=12.3, SD=2.4). We defined dysregulation by the T scores of 3 subscales (Attention, Aggression and Anxiety/Depression) in the Child Behavior Checklist. Dysregulation was defined as total T scores of 3 subscales in the CBCL more than 180. There were 54 and 31 males with ASD in the ASD+dysregulation and ASD-dysregulation groups, respectively. First, we compared cortical thickness, surface area and gyrification for ASD and TDC and test if the main findings would be different when dysregulation was controlled. Second, we investigated difference of cortical thickness, surface area and gyrification among ASD+dysregulation, ASD-dysregulation and TDC groups. Third, we explored if there is similar or different association of cortical thickness, surface area and gyrification and dysregulation in ASD and TDC groups. Age, age square term and FIQ were taken as covariates in all the analysis above. Cluster-level correction for multiple comparisons based on Monte Carlo simulation was implemented.
Results: Males with ASD had increased cortical thickness in the right rostral middle frontal cortex, increased gyrification in the left inferior temporal cortex, right superior frontal cortex and right fusiform gyrus than TD. However, these findings all disappeared when dysregulation was controlled. For group difference among ASD+dysregulation, ASD-dysregulation and TD, ASD+dysregulation had thinner cortical thickness in the left superior parietal cortex and increased gyrification in the right lingual gyrus than ASD-dysregulation. ASD+dysregulation had thicker cortical thickness in the rostral middle frontal cortex and increased gyrification in the left inferior temporal, right insular and right superiorfrontal cortex than TD. ASD-dysregulation had thicker cortical thickness in right precentral gyrus than TD. Finally, ASD and TD groups had a shared association between dysregulation and several brain regions including surface area of the right lingual cortex and gyrfication of the left superior temporal and the right superior frontal cortex. Distinct association of dysregulation and surface area of the left postcentral cortex was found in ASD and TDC groups.
Conclusions: Our findings suggest that neurobiological abnormalities found in ASD might be partially accounted for by the level of dysregulation. To explore the neural mechanism of dysregulation in ASD, several different approach such as categorical, dimensional or subgroup analysis should be considered in the future studies.

55 **141.055** White Matter Abnormalities in Girls with Autism: A Tract-Based Spatial Statistics Study

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Background:
Many diffusion tensor imaging (DTI) studies implementing tract-based spatial statistics (TBSS) in samples consisting mainly of boys have shown widespread abnormalities in white matter (WM) microstructure in autism spectrum disorder (ASD). Even though girls make up a significant minority of individuals living with ASD, they are grossly understudied relative to boys, and few studies (if any) to date have implemented DTI with TBSS in the exclusive examination of ASD girls. While there is mounting evidence supporting differences in behavioral phenotype between girls and boys with ASD, much less is known about the neural phenotype in girls living with autism.
Objectives:
Characterize WM abnormalities in ASD girls in comparison to neurotypical (NT) girls using DTI.
Methods:
This study consisted of 46 girls: 26 ASD (Age: M = 9.22 y, SD = 4.18; Full-scale IQ: M = 96.79, SD = 21.15) and 20 NT (Age: M = 10.05 y, SD = 4.14; Full-scale IQ: M = 106.13, SD = 16.01). Participants underwent diffusion-weighted MRI (2.5mm3; 30 directions at b=1000s/mm2; 5 b=0; runs=3) on a 3T Siemens scanner. The best of three runs for each participant was selected for this preliminary analysis. All scans were pre-processed using FSL, including eddy current correction and estimation of the diffusion tensor, which enables calculation of the following WM microstructure metrics: fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD), and radial diffusivity (RD). Voxel-wise group comparisons in WM microstructure were performed using TBSS which co-registers all diffusion data and generates an average WM skeleton on which statistical comparisons are made. Areas of significant difference were identified ($p < 0.05$ corrected for multiple comparisons across space) using Threshold-free Cluster Enhancement (TFCE).
Results:
There were no significant differences in age and IQ between groups. There were widespread regions of both right and left hemispheres in which MD was significantly elevated in ASD compared to NT. There were also widespread regions of both right and left hemispheres in which AD was significantly elevated in ASD compared to NT. All fiber types were represented, including association, commissure, and projection fibers. No other group comparisons reached significance; however, there was a trend towards significantly increased RD in the ASD group compared to NT.
Conclusions:
This study uses DTI and TBSS to show that ASD girls have WM abnormalities in comparison to NT girls, thus indicating that probands exhibit structural abnormalities in the brain. The pattern of abnormalities is similar to boys with respect to widespread involvement. In contrast, there appear to be some differences in which WM microstructure metrics are abnormal in girls with ASD, suggesting potential gender differences in neural phenotype.

56 **141.056** White Matter Microstructure As Candidate Brain Phenotypes of Autism

J. Villaruz[1], *D. C. Dean*[1], *B. G. Travers*[1], *A. A. Freeman*[1], *B. A. Zielinski*[2], *M. D. Prigge*[2], *J. S. Anderson*[2], *E. D. Bigler*[3], *N. Lange*[4], *S. J. Schrodi*[5], *M. Leppert*[6], *N. Matsunami*[7], *A. L. Alexander*[1] *and J. E. Lainhart*[1], *(1)University of Wisconsin - Madison, Madison, WI, (2)University of Utah, Salt Lake City, UT, (3)Brigham Young University, Provo, UT, (4)McLean Hospital, Cambridge, MA, (5)Marshfield Clinic Research Foundation, Marshfield, WI, (6)University of Utah, Department of Human Genetics, Salt Lake City, UT, (7)University of Utah School of Medicine, Salt Lake City, UT*

Background: Autism spectrum disorder (ASD) is a highly heterogeneous condition that vastly influences brain structure and development. However, despite the effort to identify brain-based causes of ASD, the mechanisms that underlie the associated neurobiological alterations remain unknown. Though the heterogeneity of neuroimaging findings has made it challenging to pinpoint specific brain-related phenotypes of ASD, identifying such features may be informative to the clinical approach of ASD. We can compare the distributions of neuroimaging-based measures from ASD individuals to those of typically developing individuals and single out brain regions that differ between these two groups. Diffusion tensor imaging (DTI) is an integral tool for studying neurobiological change and has been used to associate ASD with microstructural variations in specific white matter tracts. Thus, DTI measures may be worthwhile to distinguish brain phenotypes of ASD.
Objectives: We examined distributions of white matter microstructure of individuals with ASD and typically developing controls (TDC) as initial steps to identify brain based phenotypes of ASD.
Methods: Participants were recruited across two sites, University of Utah and University of Wisconsin-Madison, and involved 140 ASD and 85 TDC males between the ages of 3 and 42-years-old. In total, 497 (320 ASD, 177 TDC) longitudinal DTI datasets were collected. Images were corrected for distortion and head motion, while maps of FA, MD, AD, and RD were estimated. Images were then aligned to a population-specific template and mean diffusion parameters were extracted from 46 major white matter tracts, as defined by the JHU ICBM-DTI-81 template. The bilateral stria terminalis was not included in these analyses due to lack of reliable fit across participants. T-tests were performed to compare the distributions from ASD and TDC individuals using combined data and data separated by collection site.
Results: In the combined data, the ASD group had significantly different (p<0.05) white matter microstructure in 21 major tracts compared to TDC. FA in the splenium, genu, and body of the corpus callosum were the most significantly different (p = 7.51*10^{-8}, p = 1.79*10^{-6}, and p = 3.80*10^{-5}, respectively). Utah data revealed 25 tracts that had significantly different (p<0.05) microstructure in the ASD group while Wisconsin data only showed significantly different (p<0.05) microstructure in 5 tracts. In Utah data, FA was most significantly different (p=1.36*10^{-8}) in the splenium of the corpus callosum, while in Wisconsin data it was most significantly different (p=0.011) in the middle cerebellar peduncle.
Conclusions: Our results suggest that measures derived from diffusion imaging may be informative to the development of brain-based phenotypes of ASD. In particular, the splenium of the corpus callosum may be an ideal candidate for such a brain phenotype. Although the findings from the two sites are similar, the discrepancies are likely due to the larger sample size and increased number of time points in the Utah data, making it more sensitive to overall group effects. Future analyses will investigate differences in MD, RD, and AD between groups, the effect of covariates such as age, and whether candidate imaging phenotypes begin to establish possible subgroups of ASD.

Poster Session
142 - Diagnostic, Behavioral & Intellectual Assessment
12:00 PM - 1:40 PM - Golden Gate Ballroom

57 **142.057** A Comparison of Aberrant Behavior Checklist (ABC) Factor Scores in Children with Autism Spectrum Disorder (ASD) and Prader Willi Syndrome (PWS)

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Background: Autism Spectrum Disorder (ASD) is frequently diagnosed in association with Prader Willi Syndrome (PWS), a genetic disorder that results from lack of paternally derived imprinted material on chromosome 15q11-q13 (a region also implicated in the etiology of ASD). Previous studies have noted, however, that there are differences in the way that restricted and repetitive behaviors are displayed in children with ASD and PWS. To date, no research has investigated the potential differences/similarities in social impairments or associated symptoms (e.g., irritability or hyperactivity) between children with ASD and PWS.
Objectives: To compare the Aberrant Behavior Checklist (ABC) Factor Scores of (1) Lethargy/Social Withdrawal; (2) Stereotypic Behavior; (3) Inappropriate Speech; (4) Irritability; and (5) Hyperactivity/Non-compliance between children with ASD and PWS.
Methods: Children with ASD and PWS, ages 5-17, were enrolled in two separate studies. Children with ASD (n=23) participated in a randomized double-blind crossover study to evaluate the safety and efficacy of Trichuris Suis Ova (TSO), and children with PWS (n=20) participated in an 8 week double-blind treatment study of intranasal OXT (IN-OXT) vs. placebo. The ABC, a 58-item informant-based rating scale, was completed by parents during the baseline visit of both studies.
Results: There were no significant differences between children with ASD and PWS in terms of gender, race, or age. There were, however, significant baseline performance differences on the Stanford Binet-5 Abbreviated IQ (SB-5 ABIQ); children with ASD scored higher than children with PWS (t=2.204, df=41, p=0.033). The SB-5 ABIQ was therefore used as a co-variate in the analyses of the ABC Factor scores. After controlling for baseline ABIQ, children with ASD had significantly higher scores (i.e., more symptomatology) on the ABC Stereotypic Behavior Factor and the ABC Hyperactivity/Non-compliance Factor compared to children with PWS (F=33.235, p<0.001 and F=23.694, p<0.001, respectively). Differences on the ABC Irritability and Social Withdrawal/Lethargy Factors approached significance (F=3.83, p=0.057 and F=3.75, p=0.06, respectively), with ASD children again having elevated scores. No difference between the groups was found on the Inappropriate Speech Factor.
Conclusions: Compared to children with PWS, children with ASD were rated by their caregiver as having greater symptomatology across all but one of the ABC Factors. More specifically, children with ASD had significantly higher scores on the ABC Stereotypic Behavior and Hyperactivity/Non-compliance Factors. Elevated scores for children with ASD on the ABC Irritability and Lethargy/Social Withdrawal Factors approached significance compared to children with PWS. These findings were not due differences in baseline intelligence. Future studies should look at item differences *within* each ABC Factor, in terms of frequency and severity, to more explicitly differentiate their behavioral manifestations in children with ASD and PWS.

58 **142.058** A Comparison of Variability in Change Across Commonly Used Measures of Treatment Outcomes for Youth with ASD

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Background:
In contrast to the several well-validated diagnostic and assessment measures of child symptomatology and functioning, there is little consensus regarding suitable measures to assess treatment outcomes (Matson, 2007). Within the treatment literature, measures of intelligence and adaptive skills measures are commonly used as indicators of change. However, their use present several issues, including questions regarding the sensitivity to changes (McConachie et al., 2015), especially given that many of these measures were designed to measure relatively stable constructs over time (e.g., intelligence). Given the significant empirical emphasis on evaluating intervention programs for youth with ASD, the identification of sensitive, suitable measures of treatment outcomes is critical.
Objectives:
The aim of the present study is to examine variability in rate of change observed across various outcome measures in a randomized trial of classroom-based ASD intervention, including standardized measures of cognitive and adaptive abilities.
Methods:
Participants include 263 students enrolled in a large effectiveness trial of a naturalistic behavioral intervention in school settings. Students were 3-11 year old (M = 5.9 SD = 2.24) and being served under the autism educational category in public school programs. Treatment outcome measures included: 1) standardized cognitive measures (either the Differential Abilities Scale-II or the Mullen Scales of Early Learning, as appropriate for developmental level) and the Vineland Adaptive Behavior Scales-II (VABS), as completed by the student's teacher. Each measure was administered in the fall and spring of the school year. Progress across the school year on individual student goals selected by the teacher and assessed via Goal Attainment Scaling (GAS goals) were also included as a measure of change.
Results:
Results indicate the largest change in scores for the cognitive measures as compared to the VABS-II.Â Examination of associations between corresponding subscales from the cognitive measures and the VABS-II indicate a significant relationship between rates of change in receptive language but not expressive language. Further, whereas a positive association was observed between receptive language change and VABS-II expressive language, there was a negative association between expressive language and VABS-II receptive language. In terms of changes in academic functioning, there was a strong positive association between receptive language and improved academic skills; this is in contrast to the negative association observed with the VABS-II language scales. Further associations as well as potential moderating variables will be discussed.
Conclusions:
The current results suggest variability in rates of change across various common measures of treatment outcomes as data demonstrated by an inconsistent pattern of association between specific cognitive and adaptive abilities. Overall, these results lend support to the sensitivity to change in these commonly used treatment outcome measures. However, the inconsistencies seen in rate of change or progress across measures warrants further exploration.

59 **142.059** A Proposed Model of Intelligence and Its Implications for Children with Autism Spectrum Disorder

L. A. Oakes *and T. Smith, University of Rochester Medical Center, Rochester, NY*

Background: Although research indicates that IQ tests are reliable and valid measures of cognition when administered to individuals with autism spectrum disorder (ASD), it also reveals that such tests have unusual psychometric properties in this population, notably low inter-correlation among subtests, distinctive patterns of strengths and weaknesses, and over-prediction of everyday functioning. A satisfactory factor structure that explains the cognitive strengths and deficits of this population has not been identified. Nor has there been an explanation of why their adaptive behavior is not commensurate with their cognitive abilities.
Objectives: This study evaluates a new model of the structure of intelligence in the ASD population that, if confirmed, would help account for the differences. A three-domain model is proposed, consisting of language ability, perceptual ability, and social ability, with each ability further broken down into a fluid reasoning component and crystalized knowledge component. The proposed model is then compared to a conventional IQ test in regards to its ability to predict adaptive behavior.
Methods: Children with ASD, ages 6-12, with full scale IQ scores above 50, were assessed on a standardized IQ test (Stanford-Binet Intelligence Test, 5th Edition), a test of social skills (NEPSY-II), and parent-rated adaptive behavior (Vineland Adaptive Behavior Scales-II) and executive functioning (BRIEF). Factor scores were estimated from 6 variables (Verbal Knowledge, Verbal Fluid Reasoning, Nonverbal Knowledge, and Nonverbal Fluid Reasoning from the SB-5; Affect Recognition and Theory of Mind from the NEPSY-II), and a path analysis was conducted to test the fit of a model relating these factors to (1) constructs representing cognitive abilities and adaptive abilities, and (2) constructs representing the components of the new model proposed in this study (language abilities, perceptual abilities, and social abilities).
Results: Fifty-three children (44 males, 9 females) with ASD, a mean age of 9.6 (SD = 1.9), and a mean Full Scale IQ of 92.49 (SD = 19.46; range: 51-126) participated in the study. Overall, results supported the use of the SB-5 with school-age children with ASD with high inter-correlations between subtests and Full Scale IQ, $r(51)$ = 0.73 - 0.89 and between domains and Full Scale IQ, $r(51)$ = 0.88 - 0.92. The proposed model was partially supported with the inclusion of social skills and only 4 subtests of the SB-5 ($\chi 2$ (6) = 1.166, p = 0.979) and predicted adaptive behavior at least as well as the full IQ test (β = 0.42, p = 0.002). BRIEF scores did not contribute significantly to the model.
Conclusions: Â In this study, adding measures of social skills to cognitive assessments reduced the number of variables needed to predict children's use of skills in their everyday environment and resulted in predictions that were at least as accurate as a more detailed cognitive assessment. Alternatively, assessment batteries that include Full IQ tests and social skills assessment may provide significantly more information compared to conventional batteries, supporting the use of different assessment batteries than are typically used in practice.

60 **142.060** A Stratified Analysis of Subtypes in Autism Spectrum Disorders with Unsupervised Machine Learning

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Background: Increasing rates of diagnosis of Autism Spectrum Disorder (ASD) combined with high variance in abilities and disabilities of those diagnosed necessitate the need for empirically-based customization of treatment programs. Concurrently, the maturation of ubiquitous computing now allows for the large-scale and rapid collection of longitudinal clinical data which can be leveraged to train machine learning algorithms capable of detecting subtle patterns in large data repositories. Previously (https://imfar.confex.com/imfar/2016/webprogram/Paper22515.html) we demonstrated the application of unsupervised clustering models to extract behavioral subtypes of ASD based on 8 domains: cognition, executive functioning, language, motor, social, play, adaptive, and academic. These results showed that distinct skill profiles existed on the spectrum, and could serve as a basis for tuning therapy curriculum. Here we expand this work to track the stability of cluster profiles across age groups and genders, as well as model the response of patient learning in each cluster as a function of treatment intensity.
Objectives: The purpose of the present study was to identify if behavioral subtypes of ASD identified through machine learning remained stable as a function of age and gender. An additional goal of the study was to capture the relationship between learning outcomes and treatment intensity for each cluster in the age-stratified model.
Methods: Data from the SKILLS database was used to generate a 3500-dimensional vector model of patients with confirmed ASD diagnoses, with each vector element corresponding to the presence or absence of an individual behavior. These data were aggregated across the 8 domains enumerated above, resulting in an 8 dimensional feature space for approximately 2000 patients. This feature space was then stratified based on age and gender, and then clustered using Expectation Maximization with mixtures of Gaussians. Bayesian Information Criteria was used to determine the optimal number of clusters. The centroids of each cluster were then used to visualize cluster profiles for each age and gender group, as well as to measure for significance similarities and differences in clustering behavior across groups, including responsiveness to treatment intensity.
Results: Results of this study further confirmed the existence of subtypes on the autism spectrum, and the ability of these subtypes to be identified using unsupervised machine learning techniques. In particular, this study identified cluster profiles that retain the same general characteristics across age groups and genders, while others appear to change as a function of age. Similar observations were made to responses in treatment intensity. In practice this provides a heuristic for customizing treatment regimens for individuals, as well as evolving those treatment regimens in an informed fashion as the individual gets older.
Conclusions: Findings indicate the existence of distinct behavioral subtypes within a large sample of children with ASD, as well as how those subtypes vary as a function of age and gender. As noted in the past, the significance of these subtypes may span beyond behavioral treatment. Further exploration of other distinctions between these groups (e.g., genetic, medical, environmental, etc.) are warranted and currently underway.

61 **142.061** A Validation Study of the Observation for Autism Screening (OERA), a New and Brief Low-Cost Instrument to Screening for ASD

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Background:
The ADOS is the gold standard observational schedule for diagnosis of ASD. However, it is lengthy, time-consuming, costly and requires a high level of training, which makes it rarely feasible in non-research settings and large-scale proposals. This is particularly problematic in most Low-Middle-Income-Countries/LMIC. For that reason, our team developed a new tool called Structured Observation for Autism Screening/OERA.
Objectives:
(1) to describe the OERA instrument, (2) to assess its construct validity and invariance regarding gender and IQ, and (3) to calculate its sensitivity and specificity.
Methods: Local: São Paulo, Brazil. Participants: 99 children: N=79 with ASD, and n=23 children without ASD (11 with intellectual disability and 22 with typical development). Instruments: *ASD diagnosis* based on the ADI-R; *IQ* based on SON-R 2½-7 or WISC-III. Statistical analysis: (1) Evaluation of the agreement between two independent examiners via kappa coefficient, percentage of agreement and expected agreement. (2) Construct validity and invariance via confirmatory factor analysis/CFA.Â (3) Elaboration of ROC curve and its cutoff for sensitivity and specificity confronting OERA total score with clinical judgment by psychiatrist allowing to estimate the area under the curve.
Results:
OERA is an 8-item semi-structured assessment tool to screening ASD in children 3–10 years old of age. After a short training, non-specialists can administer the OERA in approximately 10 minutes, based on a standardized low-cost set of objects and toys. After that, an expert in ASD watches the record to code the 8 semi-structured items, and a list of 5 additional behaviors, summing 13 items. The unidimensional model for OERA showed:
(1) High agreement between the observers (all items above 80%);
(2) Good fitness of indices, high factor loadings (on average, factor loading=0.878), no item showed differential functioning item regarding gender and IQ, and;
(3) Area under the ROC curve=0.9443. Scores equal of greater than five correspond to a sensitivity=92.75% and specificity=90.91%.
Conclusions: The OERA was useful to identify ASD children with good psychometric features (construct validity and invariance regarding gender and IQ), discriminating children with ASD and typical development with good sensibility and specificity. This new instrument is promising to identify ASD, particularly in LMIC.

62 **142.062** A Window of Opportunity for Preventing Challenging Behavior: Increase in Heartrate Prior to Episodes of Challenging Behavior in Preschoolers with Autism

***H. J. Nuske**[1], E. Finkel[1], M. Pellecchia[1], J. D. Herrington[2], V. Parma[3], D. Hedley[4] and C. Dissanayake[5], (1)University of Pennsylvania, Philadelphia, PA, (2)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (3)SISSA, Trieste, ITALY, (4)Olga Tennison Autism Research Centre, Melbourne, AUSTRALIA, (5)School of Psychology & Public Health, Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia*

Background: Almost two thirds of children with Autism Spectrum Disorder (ASD) present with challenging behaviors which are often associated with difficulties in communication; three quarters have difficulty with emotional regulation. The most effective approach to reduce challenging behavior and its consequences require appropriate intervention before onset of the behavior. However, understanding the triggers to challenging behavior is difficult in some children, due to their limited communication abilities generally, and communicating emotions in particular. As physiological indicators such as increase in heart rate are well-established fine-grained measures of emotional regulation and stress, these indicators may provide important insights on the triggers to challenging behavior.
Objectives: To identify physiological precursors to challenging behavior episodes in pre-schoolers with autism who have frequent challenging behaviours.
Methods: Whilst wearing a lightweight wireless electrocardiogram (Biopac BioNomadix®) embedded in a speciality-made vest, 41 children with ASD aged 2-4 years were administered a testing battery including 10 tasks from the Preschool Version of the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith, Reilly, Lemery, Longley, & Prescott, 1999). These Lab-TAB tasks were designed to mimic everyday life experiences in which children would need to regulate low-level stress (e.g. waiting for a snack, interacting with a stranger) and experience positive emotion (bubbles, peek-a-boo task), spanning approximately 1 - 1.5 hours. Coders blind to diagnostic group coded challenging behaviors including aggression, self-injury, property destruction, loud noises and non-compliance.
Results: We were interested in the physiological state of children from the present sample who exhibited frequent challenging behavior. Sixteen children met this criteria and were thus included in the analysis. Analysis of heart rate data (beats per minute) from the first 3 children (physiological data processing is ongoing) indicate a mean of 39.69% (range of 32.89 – 48.31%) increase in heart rate from baseline at a mean of 52.70 secs (range of 33.11 – 71.70 secs) prior to the onset of the challenging behavior episode. These data will be supplemented with physiological (HR variability, skin conductance) and behavioral data from the full sample for presentation at IMFAR in an effort to understand how physiological stress relates to different behavior functions.
Conclusions: Â The preliminary data indicate that children with ASD show clear physiological reactivity prior to the onset of challenging behaviors, thus identifying an important window of opportunity during which caregivers may intervene. Wearable biosensors may provide a useful means by which information about the onset of challenging behavior can be communicated, leading to efforts to teach emotional regulation in situations that matter most, such as the classroom.

63 **142.063** ADOS Autism Severity As a Predictor of Language Ability in Boys and Girls with Autism Spectrum Disorder

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Background:
Autism is a neurodevelopmental disorder that affects 1 in 42 boys and 1 in 189 girls (Christensen et al. 2016). Due to this large discrepancy, there has been relatively little research that explores how autism presents in girls. Of the research that has been done, recent findings suggest that girls with autism have worse communication skills than boys of similar autism severity as measured by the autism diagnostic observation schedule (ADOS) (Hartley and Sikora 2009).
Objectives:
In the current study, we aim to examine how receptive and expressive language performance relates to ADOS autism severity scores differently in girls and boys with autism. Given the subject sample spans puberty, we assess whether these associations are different based on pubertal status in both sexes.
Methods:
Data were collected from 29 prepubescent boys, 20 post pubescent boys, 16 prepubescent girls, and 35 post pubescent girls with autism or autism spectrum diagnoses. Pubertal cutoffs were determined using the Pubertal Development Scale, autism severity was determined using the autism diagnostic observation schedule, second edition (ADOS-2), IQ was determined using the differential abilities scale (DAS), and receptive and expressive language ability were determined using the clinical evaluation of language fundamentals, fourth edition (CELF-4). IQ, age, and receptive and expressive language scores were not significantly different between boys and girls in prepubescent and post pubescent groups respectively. Eight linear regressions were run (separate tests for each sex and pubertal group for two outcome variables) with ADOS score sum predicting either expressive or receptive language scores to assess the associations between autism severity and language ability.
Results:
Preliminary analysis revealed that autism severity significantly predicted receptive language in post pubescent girls ($p = .016$, $t = -2.526$, Beta = -.403). There were marginal effects found in which autism severity predicted expressive language ($p = .075$, $t = -1.926$, Beta = -.458) and receptive language ($p = .071$, $t = -1.952$, Beta = -.462) in prepubescent girls as well as expressive language in post-pubescent girls ($p = .077$, $t = -1.824$, Beta = -.303). Autism severity did not significantly predict receptive or expressive language performance for any other group.
Conclusions:
Based on these findings, ADOS severity relates to the measure of receptive language in post pubescent girls more robustly than in boys at any pubertal stage. Additionally, the relationship suggests that receptive language ability decreases with increasing autism severity in post pubescent girls. Data collection is ongoing and more subjects will be added to increase statistical power and to see if any more significant effects are created.

64 **142.064** ASD Concordance of Twins Across DSM-IV-TR and DSM-5 Diagnostic Criteria

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Background: Â Diagnostic criteria for autism have changed under *DSM-5*, with the removal of diagnostic subcategories in favor of a single category of autism spectrum disorder (ASD). Previous research has supported a high degree of concordance for ASD among monozygotic twins, but no studies have specifically examined pairwise concordance rates using *DSM-5Â* diagnostic criteria for ASD.
Objectives: Â This study aims to examine monozygotic pairwise concordance rates for ASD from the perspective ofÂ *DSM-IV-TRÂ* andÂ *DSM-5*Â diagnostic criteria.
Methods: Â Items of a parent report measure of ASD symptoms (Autism Diagnostic Interview–Revised) and a clinical observation instrument (Autism Diagnostic Observation Schedule) were matched to diagnostic criteria, as conceptualized by Huerta et al. (2012). Diagnoses of pervasive developmental disorder and ASD were assigned to 14 pairs of monozygotic twins, in whom at least one twin had an autism diagnosis, using *DSM-IV-TR* and *DSM-5* criteria. McNemar tests were performed to determine whether there was a significant difference in sample pairwise concordance rates between *DSM-IV-TR* and *DSM-5* diagnostic criteria.
Results: With the use of both parent report and clinical observation measures (Autism Diagnostic Interview-Revised *and* Autism Diagnostic Observation Schedule), eight of the fourteen twin pairs were classified as concordant using *DSM-IV-TR* criteria, and five out of the fourteen twin pairs were classified as concordant using *DSM-5* criteria, yielding pairwise concordance rates of 57.14% and 35.71%, respectively. The use of either parent report or clinical observation (Autism Diagnostic Interview-Revised *or* Autism Diagnostic Observation Schedule) resulted in pairwise concordance rates of 85.71% for *DSM-IV-TR* criteria and 78.57% for *DSM-5* criteria. Pairwise concordance rates were not significantly different across *DSM-IV-TR* and *DSM-5* diagnostic criteria using these two methods. *DSM-5* pairwise concordance rates were significantly different when evidence of symptoms was required from either measure (78.57%) versus both measures (35.71%).
Conclusions: Pairwise concordance rates using *DSM-5* diagnostic criteria were higher if diagnoses were assigned on the basis of information from either the Autism Diagnostic Interview-Revised or the Autism Diagnostic Observation Schedule than they were if information from both sources was used. The finding of a significant difference in concordance rates using either measure as opposed to both measures has important implications for diagnostic practice. Overall, despite concerns regarding changes to the diagnostic construct of ASD with the use of *DSM-5* criteria, the present findings suggest that sample pairwise concordance rates for ASD have not substantially changed from *DSM-IV-TR* to *DSM-5* criteria. The composition of the autism spectrum has remained consistent in this sample of monozygotic twins.

65 **142.065** ASD and Neurodevelopmental Characterization of Youth with XYY Syndrome

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Background: Sex chromosomal aneuploidies are numeric aberrations of X or Y chromosomes; in the case of XYY, an extra Y chromosome is present in males. Epidemiology estimates indicate a rate of XYY in 1/1000 births, although the diagnosis is reported less frequently (Stochholm, Juul, & Gravholt, 2010). Previous studies have found significant autism spectrum disorder (ASD) symptomatology in this population, although rates vary considerably (Margari, Lamanna, Craig, Simone, & Gentile, 2014). Other prominent characteristics previously described include a slightly lower average IQ than the general population, language impairments, learning disabilities, and a variety of psychiatric diagnoses, including attention deficit hyperactivity disorder (ADHD) (Bardsley et al.,2013; Bishop et al., 2011; Leggett, Jacobs, Nation, Scerif, & Bishop, 2010). Studies of this condition have thus far not included gold-standard diagnostic instruments for ASD.
Objectives:
The purpose of this study was to report on previous community diagnoses and findings from administration of gold-standard ASD diagnostic instruments in youth with XYY. We also sought to contextualize these data based on cognitive profiles, as well as specific learning disorder (SLD), intellectual disability (ID), and ADHD diagnoses.
Methods: A sample of 50 males with XYY were enrolled in a phenotypic characterization study. The sample included an age range of 5 to 25 years (mean age=13.25±5.94). Phenotypic characterization included an IQ estimate from a Wechsler intelligence test (WISC-V, WASI or WAIS-IV). Additionally, the Autism Diagnostic Interview-Revised (ADI-R), the Autism Diagnostic Observation Schedule, second edition (ADOS-2), the Woodcock Johnson Tests of Achievement, fourth edition (WJ-IV), and the Vineland Adaptive Behavior Scales, second edition were administered.
Results: Previous diagnoses of ASD in community had been made in 36% (n=18). Additionally, based on parent report, 60% (n=30) had a previous diagnosis of ADHD. Preliminary results from 25 participants indicate that while 32% (n=8), and 24% (n=6) met diagnostic criteria on the ADI-R and ADOS-2 respectively, only 16% (n=4) were given a DSM-5 diagnosis of ASD according to results from these instruments combined with clinical judgment and clinician review of DSM-5 criteria. ADOS-2 profiles (module 2, n=1; module 3, n=18; module 4, n=6) are shown in Figure 1. NVIQ was slightly higher than VIQ, with FSIQ falling approximately 1 SD below the population average, and adaptive behavior generally lower than estimated from IQ scores (Table 1). One participant met criteria for ID (FSIQ and Vineland ABC <70). Twenty one participants completed academic testing, and 61.9% (n=13) met for SLD (FSIQ>70 and achievement standard score in at least one area <78).
Conclusions: This study found a negatively skewed IQ range, and greater deficits in VIQ compared to NVIQ in youth with XYY, consistent with previous findings (Leggett et al., 2010). While community diagnoses of ASD were higher than reports in previous studies, cohort effects may explain some differences, since rates of ASD have increased ubiquitously. While research based categorical diagnoses of ASD were reduced compared to community diagnoses in the current study, symptomatology is present and needs further exploration, especially in light of the cognitive, language and learning profiles in this group.

66 **142.066** Age of First Concerns and Age of ASD Diagnosis in a Sample of Latin American Children

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Background:
Although parents report preoccupation with their child's development, it could take years to obtain a diagnosis of ASD. Among the reasons suggested for diagnosis delay are lower levels of parent education, lower socioeconomic status (SES), limited knowledge of parents about ASD, scarcity of trained specialists, and diminished health-care knowledge. Data are also lacking on the demographic and clinical variables that might explain disparities in parental first concerns and diagnosis of ASD for different ethnic groups.
Objectives: The goal of the study was to describe the age of parental concerns, types of first parental concerns, the age at first ASD diagnosis, and factors associated with age at the first diagnosis in a sample of Latin American children.
Methods: A needs survey for caregivers of people with ASD was performed in the Latin-American Region between 2015-2016 by the Red Espectro Autista Latinoamerica (REAL). 2965 families were surveyed in six Latin-American countries (Argentina, Brazil, Chile, Dominican Republic, Uruguay and Venezuela)Â using the Autism Speaks Caregiver Needs Survey. Age of parental recognition and description of first signs were ascertained through the direct questions of the survey
Results: Age of parental first concerns varied from 20.36 in Brazil to 28.05 months in Chile with a median age of recognition of 22.22 months (SD 18.94, for the total sample. The average age of diagnosis for the total sample was 51.88 (SD 48.21), with the earliest age of diagnosis in Venezuela at 41.66 and the latest in Brazil with 57.55 months. Linear regression analysis found that country of residence is a predictor of age of diagnosis but not for the age of first concerns. Also, gender (male) and professionals consulted (neurologists) were predictors of earlier age of diagnosis ($F=73.39$, $p=.003$, $R^2=.110$). For an earlierÂ age of firstÂ concerns, professionals consulted (pediatricians) and lower child's verbal ability were significant predictors ($F=34.57$, $p=.008$, $R^2=.055$).
Conclusions:
Latin American parents were aware of developmental difficulties before the second year of life, which is consistent with parental reporting in other countries. However, their children were diagnosed months later. These results highlight the role of culture in the ASD diagnostic process. Also points into the disparity of professionals training in the diagnosis and early intervention and scarcity of services in Latin American countries. These findings warrant further study of the cultural impact on autism diagnosis and developing of public policies to speed up the diagnostic process in Latin-Americans countries.

67 **142.067** Crowdsourced Validation of a Machine Learning Classification System for Autism and ADHD

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Background: Autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) together affect >10% of the children in the United States, but considerable behavioral overlaps between the two disorders can often complicate differential diagnosis. Currently, there is no screening test designed to differentiate between the two disorders, and with waiting times from initial suspicion to diagnosis upwards of a year, methods to quickly and accurately assess risk for these and other developmental disorders are desperately needed.
Objectives: Our goal was to improve our previously published classification system to distinguish ASD from ADHD using a small set of caregiver-directed behavioral questions. We aimed to train a model that generalized well to unseen crowd-collected data comprised of subjects of varying severity to create a robust classifier capable of making accurate risk predictions as a real-world mobile screening tool.
Methods: As part of a large crowdsourcing effort, we electronically collected responses to 15 behavioral features from parents of children with ASD (n = 248) or ADHD (n = 174) to use in conjunction with our archival data set (n = 2925). We trained/tested five machine learning models on different subsets of our data (archive/survey, survey/archive, archive/archive, survey/survey, mixed/mixed) to find the model that best generalized to both data sets. We used a nested grid search cross validation for parameter optimization, and to overcome class imbalance in our training and testing trials we performed 100 random subsamplings of the majority class.
Results: Due to the high variability in our crowdsourced survey data set, our classification accuracy was lower for the survey data set than for the archive data set. However, we found that two of our models (Elastic Net and Linear Discriminant Analysis) were especially robust in classifying the crowdsourced data, specifically when trained on a mixed set of archive and survey data, indicating that including clear ASD/ADHD examples in the training set improved the classification of more difficult cases. Our final models performed with AUC = 0.89 ± 0.01 using only 15 questions.
Conclusions: These results support the potential of creating a quick, accurate, and widely accessible method for differentiating risks between ASD and ADHD for use inside or outside of clinical settings. Our success in crowdsourcing indicates that mobile administration of this screening tool is possible, and would be well received by parents of children at risk. Furthermore, the simplicity of the approach would allow for real-time calculation of risk scores and rapid feedback to clinicians and/or parents. By combining this machine learning classifier with others, we hope to create a mobile screening system that has the specificity to pinpoint ASD, ADHD, and other developmental delays. Such a mobile screening platform would provide actionable information to parents in need, regardless of geographic location or socio-economic status. Moreover, the data captured by this mobile approach would supplement the standard clinical encounter, providing both clinicians with an in-depth assessment of the patient before the clinical visit, speeding intake and accelerating the delivery of therapy.

68 **142.068** Agreement and Accuracy of ASD Diagnostic Instruments in a Sample of Adults with Average or Above-Average Intelligence

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Background: The main tools currently used for the diagnosis of Autism Spectrum Disorders (ASD), the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R), have been tested in children samples in the vast majority of published literature. However, the number of diagnoses of ASD in adulthood is constantly increasing, often representing a challenge in clinical practice. To the best of our knowledge, very few studies have addressed the reliability of the diagnostic instruments in adult high-functioning individuals.
Objectives: The present study aims to evaluate the agreement among the DSM-5 criteria, the ADOS-2 and the ADI-R scores in a sample of adults with average or above-average intelligence. Additionally, sensitivity and specificity of the diagnostic instruments will be analyzed by means of ROC curves.
Methods: From June 2013, the Autism Lab of the University of Pavia recruited 84 patients meeting the following inclusion criteria: (1) age>18 years; (2) IQ>70; (3) good comprehension of written and spoken Italian. The ADOS-2 Module 4 was administered to all patients and the ADI-R was administered to their parents or caregivers, when available. A clinical diagnosis was performed by a senior psychiatrist according to DSM-5 criteria. Statistical analysis was conducted using SPSS 21.0.
Results: 67% of our sample met diagnostic criteria for ASD. The agreement between DSM-5 criteria and ADOS-2 scores was substantial (k=0.76). On the contrary, the ADI-R fairly agreed to DSM-5 criteria (k=0.36). The accuracy resulted to be good in ADOS-2 (AUC=0.87) and fair in ADI-R (AUC=0.75).
Conclusions: Our results confirm that ADOS-2 Module 4 is a reliable instrument for the diagnosis of ASD also in adult patients with average or above-average intelligence and good verbal fluency. On the contrary, the ADI-R appears less sensible and specific for ASD diagnosis in adults.

69 **142.069** An Examination of School Psychologists' Confidence in Conducting Evaluations for Autism Spectrum Disorder

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Background: Recent estimates from the CDC suggest approximately 1 in 68 individuals are diagnosed with autism spectrum disorder (ASD) in the United States (Christensen et al., 2016). Within this group, boys are approximately 4.5 times more likely to be diagnosed than girls, which may reflect a difference in symptom presentations between boys and girls (“Facts About ASDs,” 2016; Rynkiewicz et al., 2016). The median age of initial ASD diagnosis ranges between 3 years, 10 months and 6 years, 2 months. Further, as many as 24% of children are first evaluated for ASD while enrolled in public schools. These figures suggest school psychologists must possess both competence and confidence when conducting ASD evaluations that lead to appropriate educational placement and services (Shriver, Allen, & Mathews, 1999). While little research has been conducted in this area, initial findings suggest a relationship between confidence and accuracy with school-based providers when identifying individuals with ASD (Hedley and colleagues, 2016).
Objectives: The current study examined confidence levels reported by school psychologists working for public school districts in Georgia.Â Specifically, we explored confidence levels related to the assessment of ASD with consideration for both students’ gender and age. We also examined predictive factors associated with higher levels of confidence including a) the average number of initial ASD evaluations conducted each year, b) years of experience as a school psychologist, and c) level of education.
Â Methods: AÂ 28-question, electronic survey was completed by 300 school psychologists who currently work in Georgia public schools. Based on IDEA section 618 data (U.S. Department of Education, 2016), the respondents represented approximately 42% of school psychologists in the state. Sample representativeness was deemed sufficient through a comparison of the respondents’ reported geographic region and the student populations for the 12 regions in the state.Â Chi-square tests of independence and binary logistic regression were employed to gauge statistical relationships.
Results: Results revealed no difference in school psychologists’ confidence when assessing ASD in male versus female students (p = 0.114). High versus Low Confidence levels were evaluated across age levels served, including preschool (2:10 – 4 years), elementary school (5 – 10 years), and middle/high school (11 – 18 years) aged children. High Confidence ratings for preschool-aged children were significantly lower than High Confidence ratings for elementary and middle/high school-aged children (33.3% versus 80.4% and 83.3%; p < 0.001). Univariate logistic models, considering school psychologists’ High Confidence in assessing ASD, found the highest confidence levels in practitioners with a doctoral degree (p = 0.090) and those who conducted more than ten initial ASD evaluations (p = 0.020) each year.
Conclusions: School psychologists reported similar levels of confidence in evaluating children across gender. Our findings support that greater educational training and clinical practice is predictive of higher confidence, which is consistent with results from the literature (Rasmussen, 2009). Further, school psychologists reported less confidence when assessing preschool children, a critical point given the current focus on early identification.

70 **142.070** An International Clinical Cross-Sectional Study on Ability and Disability in Autism Spectrum Disorder (ASD) Using the WHO ICF-CY Framework

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Background:
The International Classification of Functioning, Disability and Health was developed by the World Health Organization (WHO) to provide a comprehensive and universally accepted framework for describing aspects of health-related functioning. The ICF is based on an integrative bio-psycho-social model of functioning, comprising of 1685 categories related to various components of health, specifically; body functions, body structures, activities (execution of tasks), participation (involvement in life situation) and environmental factors (physical, social and attitudinal environment of people). Although the ICF provides a comprehensive and in-depth description of health-related functioning aspects, using it in clinical practice would be rather impractical, as all categories are not applicable to a certain health condition. To address this issue, the development of ICF Core Sets was initiated; lists of generally agreed-upon ICF categories pertinent to a specific health condition. In this project, Karolinska Institutet Center of Neurodevelopmental Disorders (KIND), in cooperation with the WHO, has initiated the process of developing ICF Core Sets for Autism Spectrum Disorder (ASD). The development process includes four preparatory studies, each aiming to capture specific perspective on functioning and disability in ASD.
Objectives:
This study is the fourth empirical investigation to develop ICF Core Sets for ASD. The objective was to identify common problems in functioning experienced by individuals with ASD in clinical setting as documented by the ICF.
Methods:
An empirical cross-sectional multicenter study was conducted, involving 10 countries from 4 WHO-regions (Eastern Mediterranean, Europe, The Americas and Western Pacific). Experienced clinicians and clinical researchers rated the functioning level of individuals with ASD across the lifespan using an ICF checklist. The checklist consisted of 148 categories, of which 65 were related to activities and participation, 48 to body functions and 35 to environmental factors. The rating of functioning level was based on different information sources, namely medical records, medical history, interviews with participant or caregivers, and clinical observation. Absolute and relative frequency analysis was conducted to identify functioning categories that were considered to be significantly affected by ASD.
Results:
The study yielded in total 122 clinical cases of ASD. To include the most relevant ICF categories pertaining to ASD, only those that were identified to be significantly affected by ASD in at least 10 % of the cases were selected as candidate categories. This left us with 64 activities and participation categories (most identified category; d220 undertaking multiple tasks, n = 106; 87 %), 41 body functions (most identified category; b122 global psychosocial functions, n = 108, 89 %) and 35 environmental factors (most identified category; e310 immediate family, n = 103, 84 %).
Conclusions:
The present study identified broad arrays of functioning aspects and contextual factors to be relevant in ASD, supporting the notion that the impact of ASD extends beyond the core behavioral features of the condition. This study, along with three other preparatory studies, will provide the scientific basis to define ICF Core Sets for ASD, of which assessment or diagnostic tools can be used in multiple settings involving clinical care, education and research.

71 **142.071** Analysis of Autism Diagnostic Observation Schedule (ADOS) Applied to Chilean Children with Suspicion of Autism Spectrum Disorder (ASD)

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Background: The increasing prevalence of ASD in developed countries has been well documented. However, lack of knowledge is reported with regards to the prevalence of this condition in developing countries, with the consequent unawareness of the global variation of these disorders (Germain et al. 2015). In our clinical practice in a Chilean child Neuropsychiatry service, increasing prevalence has been noticed in the last decade. Great importance has been given to the adjustment of our diagnostic tools for timely treatment, considering that the diagnosis and early intervention improves prognosis in these patients (Zwaigenbaum et al., 2015). The Autism Diagnostic Observation Schedule (ADOS) is considered one of the "gold standards" in the diagnosis and research of ASD, determining severity and helping to plan the intervention. Studying a sample of patients under control with this tool will allow us to contrast Chile´s reality with the rest of the world.
Objectives: To evaluate the characteristics of a representative sample of Chilean patients with suspicion of ASD by using the ADOS, and compare the results with those reported in international publications.
Methods: Observational retrospective study of patients with suspicion of ASD, tested with ADOS in a Neuropsychiatry service of a Chilean Public Hospital. 108 children were included, between 1 and 15 years (average age=5.79, median=4). Patients were separated by age and range of severity and the results were analyzed statistically.
Results: Of the 108 children who were tested with ADOS, 88% met criteria for ASD, while 13 did not qualify as ASD (12.0%). Severity: In all, 6.6% had minimal evidence, 9.4% had mild ASD, 4.7% had moderate ASD, 5.6% had mild autism, 34.5% had moderate autism and 23,6% had severe autism. Age: In the sample composed by infant, toddler, preschoolers and schoolchildren, 58% were diagnosed with ASD. In the adolescent group, 54% were autistic. Among the patients that met ADOS criteria for ASD, children between 0 and 5 years graded 2.87 points higher in social affectation than children with ages between 6 to 15 years (p=0.00886). Non-significant differences were found in restricted and repetitive behaviors between different age groups (p=0.519)
Conclusions: Although the diagnosis of ASD is clinical, the ADOS relates to a useful diagnostic tool in the clinical practice, which allows determining severity and make valid comparisons between different populations. Our study confirmed the diagnosis in 88% of patients with suspicions of ASD, a reality in accordance with the data reported in international literature (Molloy et al. 2011).

72 **142.072** Anandamide As a Blood-Based Biomarker in Children with Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) is a brain disorder that emerges in early childhood and is characterized by social functioning impairments and repetitive, and stereotyped behaviors. Optimal outcomes rely on early identification and intervention, but progress has been hindered by a poor understanding of ASD pathophysiology. Identification of a diagnostic or phenotypic ASD biomarker would enhance therapeutic development by identifying novel intervention targets. Recent data have shown that endogenous cannabinoids (endocannabinoids, or eCBs), a class of lipid neuromodulators that regulate neurotransmitter release, also contribute to social functioning. Moreover, preclinical ASD research implicates the major eCBs, anandamide (AEA) and 2-arachidonoylglycerol (2-AG), in ASD pathophysiology.
Objectives: We sought to develop a reproducible liquid chromatography with tandem mass spectrometry (LC-MS/MS) method to detect and quantify endocannabinoid (eCB) levels in small volumes of peripherally sampled human blood. LC-MS/MS is the most comprehensive method to quantitatively characterize lipids in children with ASD. The methodology was used to compare plasma eCB levels between children with and without ASD and to test whether eCB levels predicted behavioral measures. We hypothesized that children with ASD would have altered eCB tone compared to neurotypical controls, and that plasma eCB concentrations would be related to variation in ASD behavioral functioning.
Methods: A conventional toluene liquid-liquid extraction was compared to a modified salting-out assisted liquid-liquid extraction (SALLE) with acetonitrile on reproducibility, efficiency, and matrix effects. Following lipid extraction, an optimized LC-MS/MS method was used to quantify AEA (350Da) levels in banked plasma samples collected from phenotypically well-characterized children with ASD (N=57) and matched neurotypical controls (N=54). A TSQ Vantage triple quadrupole mass spectrometer coupled with an Accela 1250 HPLC system was operated in positive mode using heated electrospray ionization. Data acquisition was performed in selected reaction monitoring mode and processed with Xcalibur software. We used JMP 12.1 to analyze data with general linear models that corrected for age, gender, ethnicity, and LC-MS/MS sample run.
Results: SALLE reduced extraction time, increased recovery, and enhanced inter-sample consistency. LC-MS/MS methodology was highly sensitive with lower limits of quantitation for AEA at 50fg. Blood AEA levels were similar in children with ASD and neurotypical controls (mean ± SE: 334±14 vs. 343±14 pg/mL; $F_{1,102}$=0.73; p=0.395). Among children with ASD, IQ was both lower than in controls (83.6±3.7 vs. 115.5±1.3; $F_{1,102}$=59.46; p<0.0001) and negatively correlated with AEA concentrations ($F_{1,57}$=8.05, p=.007). Thus, when controlling for IQ, blood AEA concentrations were significantly lower in children with ASD than in neurotypical controls ($F_{1,101}$=6.63; p=0.012). In children with ASD, blood AEA levels, controlling for IQ, negatively predicted total scores on the Vineland Adaptive Behavior Scale (VABS; $F_{1,46}$=5.22; p=0.027), and more specifically, scores on the Socialization ($F_{1,47}$=4.28, p=0.044) and Motor Skills ($F_{1,46}$=7.17, p=0.010) subscales.
Conclusions: These preliminary findings demonstrate that children with ASD show abnormalities in blood eCB levels compared to neurotypical control children, and that blood eCB levels may predict behavioral measures in children with ASD. Results implicate a meaningful role of AEA tone in ASD pathophysiology and suggest that AEA may hold promise as a peripheral marker of ASD pathophysiology.

73 **142.073** Anxiety Problems Relate to Teacher-Reported Classroom Performance in Children with ASD but Not ADHD

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Background:
Comorbid psychiatric disorders occur at elevated rates in individuals with Autism Spectrum Disorders (ASD). In particular, assessments reveal that anxiety and ADHD symptoms frequently exist in the ASD population. A meta-analysis found an anxiety rate of 39.6% in children with ASD (van Steensel et al. 2011). Emotions and behaviors associated with psychiatric problems exacerbate impairments that individuals with ASD face, and increased anxiety relates to suboptimal outcomes in adults. The classroom presents a real-world scenario to assess outcomes in children. A recent school study indicated that social anxiety predicts poor outcome related to cognitive ability (Pellecchia et al. 2016). Further analysis of the relationship between anxiety and classroom performance will provide insight into the factors that contribute to outcome in youth with ASD. Exploring the specificity of the effect to ASD relative to other developmental disorders is also relevant. This study thus included an ADHD group as a comparative sample.
Objectives:
To determine whether anxiety symptoms in children with ASD relate to teacher-reported classroom performance after accounting for sex, IQ, ASD, and ADHD symptoms, and to explore the specificity of the effect to ASD.
Methods:
Children with ASD (N=36) or ADHD (N=88) participated in a randomized comparative study of two school-based intervention programs. Parents completed the Child Behavior Checklist (CBCL, Achenbach & Rescorla, 2001) as a baseline measure of emotional and behavioral characteristics. Teachers reported classroom performance using the Swanson, Kotkin, Agler, M-Flynn, and Pelham Scale, which includes 11 standard items that are rated on a 7 point scale (SKAMP, Swanson, 1992). The relationship between parent-reported anxiety and classroom behavior was analyzed using a linear regression model. CBCL Anxiety Problems and Attention Deficit/Hyperactivity Problems *t*-scores were used as measures of anxiety and ADHD symptoms. After first controlling for the effects of sex, IQ, and ASD symptoms alone and subsequently accounting for ADHD comorbidity, the model measured the effect of anxiety on the total SKAMP scores in the ASD group. A similar analysis accounting for sex, IQ, and ADHD symptoms was repeated for the ADHD group.
Results:
After controlling for the effects of sex, IQ, and ASD symptoms, anxiety was significantly related to SKAMP scores in individuals with ASD (β=.473, p=.009) and accounted for 21.2% of the variance. The effect remained when ADHD symptoms were incorporated into the model (β=.398, p=.041). After accounting for sex, IQ, and ADHD symptoms, this pattern was not observed in the ADHD group (β=-.201, p=.139). Given these findings, Pearson correlations between individual SKAMP items were explored. Significant associations were found in the ASD group related to starting assignments, sticking with tasks or activities, attending to activities or discussions, and completing assignments (Table 2; all r>.414, p<0.012).
Conclusions:
The analysis suggests that parent-related anxiety relates to teacher-reported classroom performance in children with ASD after accounting for sex, IQ, and ASD symptoms. This association was not observed in the ADHD group. The knowledge that anxiety contributes to aspects of classroom outcome, such as completing assignments, underscores the importance of recognizing and treating anxiety in children with autism.

74 **142.074** Application of the Brief Observation of Social Communication Change (BOSCC) to a Short Term Parent Mediated Intervention Trial

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Background: The measurement of small yet meaningful social communication change in children with autism spectrum disorder (ASD) is critically important to the development of effective short-term interventions (McConachie et al., 2015). To that end, the Brief Observation of Social Communication Change was developed (BOSCC; Grzadzinski, Lord et al., 2016). The BOSCC is a measure of social communication change for use in children with little to no language coded from parent-child play interactions. It has been found to have high inter-rater, test-retest and convergence with other measures (Gradzinski et al., 2016; Kitzerow et al., 2015).
Objectives: To assess the sensitivity to change of the BOSCC over the course of a short term (10-week; 20 sessions) randomized intervention trial and three months later at follow-up. Additionally, to determine the effect of a number of moderating variables on BOSCC scores at entry.
Methods: Eighty-six parent child dyads were randomized to receive a ten-week parent mediated social communication intervention. A prior analysis found that the group receiving the parent-mediated JASPER intervention spent significantly more time spent jointly engaged and showed higher parental responsivity compared with the psychoeducation control group (Kasari et al., 2015; Shire, Gulsrud & Kasari, 2016). The primary outcome measure for this analysis was the BOSCC, scored by two reliable coders from a ten-minute unstructured parent-child play interaction. Additionally, data from the Autism Diagnostic Observation Schedule (ADOS), Early Social Communication Scales (ESCS), the Mullen Scales of Early Learning (MSEL), the Reynell Developmental Language Scales-Revised (Reynell) and Maternal Behavior Responsiveness Scales (MBRS) as well as demographic information were collected at each time point.
Results: Group differences on BOSCC TOTAL composite or domain scores were not found and so data was collapsed across groups. Change across time was assessed at the item, domain, and composite level using a linear mixed effects model. Overall, there was a significant decrease (signifying improvement) on BOSCC scores for the total composite score (d=.56) as well as both the social communication (SC; d=.56) and restricted and repetitive behaviors domains (RRB; d=.27). These decreases maintained at follow-up. Seven of ten SC domain items evidenced significant decreases from entry to exit (table 1). A median split was conducted for significantly correlated predictors and independent samples T-tests were run comparing the TOTAL composite scores of the median split groups. Significant differences on BOSCC scores at entry were found between the median-split groups for mental age (MA), IJA, composite language score, and parental responsivity (Table 2) with lower BOSCC scores associated with higher abilities.
Conclusions: Overall, the sensitivity of the BOSCC as a measure of social communication change was confirmed. Significant differences were found over the ten-week intervention period which were maintained at follow-up three months later. Additionally, it was found that a number of predictors such as MA, IJA, language, and caregiver responsiveness moderate BOSCC scores at entry. As caregiver responsiveness was found to be related to BOSCC scores, future directions include further exploration of the parental factors that influence the validity of the BOSCC as a measure of children's social communication change.

75 **142.075** Are Diagnostic Instruments Equally Accurate at Classifying Autism Spectrum Disorder in Males and Females?

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Background: In cognitively-able samples, the male to female ratio in Autism Spectrum Disorder (ASD) is up to 10:1 (Fombonne, 2009). One hypothesis for the sex discrepancy isÂ thatÂ diagnostic criteria is orientated towards a presentation typically seen in males (Kreiser & White, 2014). It is argued as a result, females are systematically under-diagnosed, a phenomena termed the 'male bias' (Kirkovski et al., 2013). With increasing evidence that females presenting with clinically significant traits are less likely to receive a diagnosis, many are highlighting the need for gender-specific thresholds in ASD assessments (Constantino and Chairman, 2012;Â Dworzynski et al., 2012). However, examination of diagnostic instruments is required to ascertain whether tools are indeed less accurate at diagnosing ASD in females, and to identify the areas of inaccuracy, before such gendered tools may be developed.
Objectives: Three aims were identified; 1) to examine whether diagnostic tools' classifications of males and females differed in diagnostic accuracy. 2) To compare the accuracy of diagnostic tools by sex i.e. to investigate whether a tool may be more accurate at diagnosing females. 3) To investigate whether behavioural domain classifications (i.e. areas of deficits that relate to diagnostic algorithms) of males and females differed in diagnostic accuracy, in order to identify specific areas of inaccuracy for the development of gender-specific thresholds.
Methods: Autism Diagnostic Observational Schedule (ADOS) (Lord et al., 2000) and Developmental, Dimensional and Diagnostic Interview (3Di) (Skuse et al., 2004) classifications of 256 males and 60 females were compared against the 'gold standard' multidisciplinary team assessment diagnosis.Â Receiver Operating Characteristics curves of ADOS and 3Di classifications of males and females were performed to describe diagnostic accuracy, measured by sensitivity and specificity. Participants data was selected from a database of consecutive referrals for the assessment of high-functioning ASD. ADOS and 3Di assessments took place concurrently as part of routine clinical practice.
Results: Chi-square and Fisher's exact test found no significant differences in the sensitivity or specificity of overall or behavioural domain classifications of males and females. McNemar's test found no significant differences in the sensitivity of ADOS and 3Di classifications of males or females but found the 3Di showed significantly lower specificity than the ADOS of males and females.
Conclusions: The 3Di and ADOS are found to be equally accurate at classifying ASD in males and females. The 3Di and ADOS show comparable accuracy classifying both males and females but the 3Di showed comparably lower accuracy classifying non-spectrum individuals. Thus, when ruling out ASD is of greater importance, the ADOS may be a more accurate diagnostic instrutment for both males and females. No behavioural domain was found to be less accurate classifying females, thus the results do not identify areas of inaccuracy to recommend the development of gender-specific thresholds in these tools. In conclusion, the 3Di and ADOS show equal accuracy classifying high-functioning males and females referred for clinical assessment.

76 **142.076** Assessing PTSD in Persons with Autism Spectrum Disorders

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Background: Previous research has indicated that roughly 63% to 77% of adolescents diagnosed with ASD will experience bullying (IAN, 2012; Cappadocia, Weiss, & Pepler, 2012). Idsoe, Dyregrov, & Idsoe (2012) explored the psychological impact of bullying in neurotypical students by assessing students for symptoms of PTSD. They reported that approximately one third of bullied students met criteria for PTSD.
Objectives: The primary objective of the current study was to examine the association between bullying victimization and PTSD symptoms in adolescents with ASD. Research questions sought to assess if adolescents diagnosed with ASD would report being bullied more frequently than their neurotypical peers, and if PTSD symptoms would be reported at similar rates for both ASD and neurotypical youth.
Methods: A total of 33 adolescents (*n*=10 in the ASD group; *n*=23 in the non-ASD group) and 52 parents (*n*=19 in the ASD group; *n*=33 in the non-ASD group) participated in an online survey. The survey assessed the frequency that the adolescent has experienced bullying, has participated in bullying others, and PTSD symptoms that were a consequence of bullying experiences. All participants were administered the Olweus Revised Bullying and Victimization Questionnaire (OBQ) as well as the Children Revised Impact of Events Scale (CRIES; 8) and CRIES (13).
Results: Sixty-seven percent of parent respondents in the ASD group reported their child was bullied at least two to three times per month, and 55% of parents reported their child was bullied at least once a week. Forty percent of victims in the ASD group met or exceeded cutoff criteria on both the CRIES (8) and CRIES (13) PTSD measure. Within the non-ASD group, 15% of parents reported their children experienced victimization two to three times per month, and 12% of victims met criteria for the CRIES (13), while 27% met criteria for the CRIES (8). There was strong agreement between adolescent and parent report.
Conclusions: Results of the current study suggest that there was indeed an association between bullying victimization and meeting PTSD cutoff criteria in both groups. Moreover, results of the current study are consistent with research that has assessed the frequency that ASD youth experience bullying (IAN, 2012; Cappadocia et al., 2012) as well as research that has assessed the frequency neurotypical youth experience PTSD symptoms as a result of bullying experiences (Idsoe et al., 2012). The findings of the current study indicate a clear need for future research relating to assessing PTSD in the ASD population as well as research that seeks to accurately capture the frequency that youth diagnosed with ASD experience bullying. Future research could also focus on the efficacy of bullying prevention programs and how those programs may reduce the frequency and impact that bullying can have in the ASD community.

77 **142.077** Assessing Social, Behavioral and Emotional Functioning in Autism: A Feasibility Pilot Study

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Background:
The clinical assessment of global functioning in children with autism is essential in order to identify needs and to arrange therapeutic and educational interventions. Appropriateness of using rapid and cost-effective instruments, as the Strengths and Difficulties Questionnaire (SDQ) and the Health of the Nation Outcome Scales for Children and Adolescents (HoNOSCA), needs further evaluation and definition, in particular in children with low-functioning autism.
Objectives:
Through a pilot observational study to describe the trend in different areas (behavior, socialization, emotions) using SDQ and HoNOSCA, and to explore correlation pathways between the two instruments, thus to plan an adequate and wide collaborative study.
Methods:
Ten consecutive new patients with low-functioning autism (age 5-14 years) were enrolled between November 2015 and October 2016. The SDQ is a 25-item questionnaire useful to screen emotional, behavioral and social problems in children aged 4-16 years. Scores for the 5 subscales (emotional symptoms, conduct problems, hyperactivity/inattention, peer problems and prosocial behavior) are classified in “normal”, “borderline” and “abnormal” ranges, according to the original cut-offs. The HoNOSCA is a 15-item clinical assessment scale used as part of the routine outcome monitoring in mental health services, especially in Netherlands, UK, Australia and New Zealand, which measures global functioning in patients aged 3-18 years through 4 different areas: behavioral, impairment, symptoms, social functioning. The SDQ completed by the educators was compared to the results of the global functioning evaluation of the clinician, who has used the HoNOSCA scale. A single psychologist completed the HoNOSCA questionnaire. Associations have been assessed with Pearson linear correlation index and minimum spanning tree algorithm.
Results:
The SDQ subscales with abnormal mean scores were “peer relations” (mean: 5.8, SD: 1.03) and “pro-sociality” (mean: 1.4, SD: 1.4), while in the HoNOSCA the social functioning domain resulted as the most problematic area. Linear correlation matrix between the items of the two instruments showed interesting values of r- index between behavioral score of HoNOSCA and both emotional difficulties (r = 0.71, *p* 0.02) and peer relationships of SDQ (r = 0.55,Â *p* = 0.09), and between social functioning score of HoNOSCA and behavioral problems of SDQ (r = 0.52, *p* = 0.12). These association were also confirmed by a map projection using the minimum spanning tree method (fig.1).
Conclusions:
The correlation between SDQ and HoNOSCA can be a simple and efficient way to screen for emotional disorders and behavioral problems in child and adolescents with low-functioning autism. It could help to recognize co-occurring disorders and reduce with appropriate interventions their impact on social functioning and peer relationship domains. However, further more systematic attempts at validation are warranted.

78 **142.078** Assessing Visuomotor Deficits in Children with SPD

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Background: Visuomotor control is the process by which individuals integrate visual perception and motor coordination systems. Visuomotor control is thought to have important implications for academic and social development. Mounting evidence suggests that abnormal visuomotor processes are common to various neurodevelopmental disorders. Specifically, children with sensory processing dysfunction (SPD) are anecdotally reported to have challenges with dysgraphia which is predicated on visuomotor integration. Previously, scant attention has been devoted to directly assessing visuomotor deficits in this population.
Objectives: In this study, we aim to determine whether children with SPD show deficits in visuomotor integration using two direct assessment measures, one a standard clinical test and the other an experimental assessment. Further we are interested in investigating correlations between visuomotor outcomes and measures of white matter integrity in the SPD group to better understand the biologic underpinnings of this disorder.
Methods: In this project, we collected visuomotor assessments and DTI imaging in 42 children with SPD (mean age 10 +/- 1.5) and 34 typically developing controls (TDC; mean age 10.2 +/- 1.3). The visuomotor battery included the Beery-Buktenica Developmental Test of Visual-Motor Integration, (Beery™Â VMI; copying, matching and tracing subtests) and the Project: EVO™ (EVO™) navigation assessment. The EVO™ tool is a scientifically derived iPad videogame-like assessment with embedded adaptive algorithms. The EVO™navigation assessment requires the player to steer their character through a dynamically moving environment with the goal of avoiding the walls and obstacles. Further, we assessed for correlations between our visuomotor measures and mean fractional anisotropy (FA) in selected regions of interest (ROI).
Results: Outcomes from our independent t-test group analysis revealed no significant group differences in any of the Beery VMI subtests, however the SPD group did preform significantly worse compared to the TDC group in the EVO™ navigation assessment. Results from our neuroimaging brain-behavior correlational analysis showed that the copy, matching and tracing subtests of the Beery VMI and the EVO™navigation assessment showed some overlapping and some unique tracts which appear to mediate these visuomotor abilities. The tracing subtest of the Beery VMI showed the most significant correlations.
Conclusions: These finds suggest that EVO™ navigation assessment may be more sensitive than the Beery VMI for assessing visuomotor integration deficits in children with neurodevelopmental disabilities, including SPD. This could be due to the adaptive and game-like features of the EVO™ navigation assessment, which minimize boredom and increase engagement. The ROIs that correlated with visuomotor deficits are areas thought to be involved in connecting lower-cortical regions to the motor cortex and frontal lobes. This might suggest faulty connectivity between these regions in children with SPD. These findings provide new insight into the biological implications for visuomotor deficits observed in children with SPD.

79 **142.079** Autism Quotient Scores Modulate the Perception and Production of Text Specificity in Typical Adult Females

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Background: Successful communication is a careful balancing act: speakers must gauge the appropriateness of producing statements that are highly detailed vs. statements that are more general. Whereas too much detail may overwhelm the listener, vague statements with too little detail can sound vacuous. In this study, we begin to test the hypothesis that some communication difficulties experienced by individuals with autism spectrum disorder (ASD) may be due to challenges in understanding or producing appropriate levels of communicative specificity during conversation. To enhance the scalability of our efforts, we use a novel, automated tool to accurately quantify sentence specificity (Li & Nenkova, AAAI 2015). Our long-term goal is to determine the extent to which existing automated tools and computational theories of language vagueness and specificity can elucidate differences between individuals with ASD and typical controls, for the purposes of enhancing screening, diagnosis, treatment planning, and intervention response measurement.
Objectives: Test whether people with high- vs. low-Autism Quotient scores (AQ; Baron-Cohen et al., 2001) differ in their (1) perception of sentence specificity and (2) propensity to generalize content during a summarization task, as indicated by automatic measures of sentence specificity.Â
Methods: Participants included 62 typically developing undergraduate students (38 females, all native speakers of English). Participants took the AQ test (higher scores indicate more ASD-like symptoms), rated for specificity 40 sentences drawn from news (0-6, lower rating=more specific), and summarized two texts, one with rich specific detail and one more general. An automated specificity measurement tool was applied to the original articles and to article summaries produced by participants. We computed Spearman correlations between participants' AQ scores and: (1) the deviation of their sentence specificity ratings from average sentence ratings collected from ~30 independent raters per sentence, and (2) specificity scores of the article summaries.
Results: Preliminary analyses revealed significant gender differences in both AQ and specificity judgments; male and female data were thus analyzed separately. We found no correlation (rho=-0.01) between male judgments of specificity and AQ. For females, however, the correlation between perceived specificity and AQ score was -0.29, trending toward significance (p=0.08). Women with higher AQ scores perceived sentences to be more specific than women with lower AQ scores. In the summarization task, we found that females with higher AQ scores tended to write summaries that were more general (rho=-0.22, p=0.18).
Conclusions: Our study is the first to examine the perception and production of linguistic specificity in people with varying degrees of autism-like symptoms. Although preliminary, our results reveal previously unexplored gender differences, which we plan to confirm with a larger sample and participants with official ASD diagnoses (anticipated by May 2017). This is the first step in a research program aimed at developing technology-augmented interventions to visualize the mismatch in expectations regarding specificity to both typical people and individuals with ASD, to improve the quality of communication across the two groups. Furthermore, we aim to develop a battery of tests to quantify an individual's perception of specificity, and explore the use of these metrics for assessing intervention effectiveness.

80 **142.080** Autism Screening in High-Risk Children in a Community Early Intervention Setting

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Background: Early detection of autism spectrum disorder (ASD) is imperative for access to ASD-specific intervention which leads to better outcomes for children with ASD. Children may be at increased risk for ASD due to a number of factors, including having an older sibling with ASD and/or being flagged for possible developmental delays. High-risk children are in need of timely referrals for ASD evaluation and ASD-specific intervention. While research suggests that the Modified Checklist for Autism in Toddlers (M-CHAT) is effective at screening in older and/or high risk children, there is limited research on the feasibility of screening within these populations.
Objectives:

1. To assess three components of feasibility: demand, implementation, and integration of M-CHAT-R/F screening among intake staff at Elwyn SEEDS, which is the local education agency for preschool early intervention services (ages 3-5) in Philadelphia.
2. To measure preliminary validity of the M-CHAT-R/F in this population.

Methods:
Elwyn SEEDS agreed to administer the M-CHAT, Revised, with Follow-Up (M-CHAT-R/F) during all intake calls. Intake staff attended training prior to deployment of the screening protocol. Archival records (n=792) of children who completed intake between May and August 2015 were extracted and reviewed. Mean age at intake was 41.36 months (SD=10.59, range 27.40-70.13 months). Variables extracted from records included demographic variables, M-CHAT-R item responses and total score, diagnosis, eligibility, referral source, and interventions received.
Results: Feasibility of M-CHAT-R administration during intake was variable. Demand was low: less than half of the files included a completed M-CHAT-R. Implementation was poor: 75 M-CHAT-R forms contained one or more errors. Integration showed some change following deployment of the screening protocol, 23% of children who screened positive (n=15) were referred for ASD evaluation compared to 3% of children who screened negative M-CHAT-R (n=5) and 9% of those who did not have an M-CHAT-R screen (n=30). There were 90 (24.59%) positive M-CHAT-R screens in this sample, of whom 15 were diagnosed with ASD; an additional 48 were diagnosed with developmental delays, but it is unknown if they were referred for an ASD evaluation. Three additional cases diagnosed with ASD screened negative on the M-CHAT-R. Estimates of psychometric properties were 83% for sensitivity, 75% for specificity, and 24% for PPV, but must be interpreted with caution due to poor adherence to the screening protocol.
Conclusions: Screening is important for detecting ASD in children, which leads to better outcomes for a child. Demand, use of the tool, was low in a high-risk community setting. Implementation, correctly administering the tool, was poor, and integration, or incorporation of the tool into current processes, showed some improvement. The low completion rate suggests barriers to implementing screening during intake at Elwyn SEEDS. However, when used, the M-CHAT-R is successful at detecting many of the cases diagnosed with ASD. Therefore, it is essential to improve uptake of screening procedures in community settings. Strategies to increase feasibility of autism screening include qualitative studies to determine the barriers to screening, completing evaluations, ongoing training for the staff administering the MCHAT-R and understanding early intervention providers' beliefs.

81 **142.081** Broader Autism Phenotype in the Mother Is Associated with Discordance in the Social Communication Questionnaire Compared to Best Clinician Estimate

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Background:
Parent-based screening for autism spectrum disorder (ASD) is a common, efficient way to identify children needing further evaluation for ASD. To reduce misdiagnosis, it is important to identify factors that influence parent ratings of ASD characteristics. One bias that could increase misreporting isÂ presence of the broader autism phenotype (BAP) in the informant (usually the mother). BAP reflects sub-clinical ASD traits (including pragmatic and broad communication difficulties and poor social skills) reported more frequently in families of children with ASD.
Objectives:
To determine whether BAP in mothers is associated with their reports of at-risk ASD characteristics for their children on an ASD screening instrument when discordant with best estimate clinical judgment. We assess whether discordance is due to over- or under-reporting on the screening instrument compared to the clinician's best estimate.
Methods:
We used data on children aged 3-5 years with ASD or developmental disabilities potentially related to ASD, identified through health clinics, early intervention and special education programs, who participated in the Study to Explore Early Development. Upon enrollment, children were screened using the mother-completed Social Communication Questionnaire (SCQ). To increase sensitivity, SCQ scores ≥ 11 were considered positive for ASD risk. These children underwent full developmental assessments, which included the Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview–Revised (ADI-R). Children who had previous ASD diagnosis or clinician suspicion of ASD underwent full developmental assessment, even if SCQ scores were <11. Best clinical estimate of ASD was determined using the Ohio State University Autism Rating Scale (OARS). A study clinician condensed information from the ADOS, ADI-R, SCQ, and clinician impression to complete a five point rating scale of certainty that a child has ASD; scores ≥4 were considered "positive". Screening discordance was defined as "over-reporting" (a positive SCQ with negative OARS) or "under-reporting" (negative SCQ and positive OARS). The mother's spouse, close family member, or friend completed a standardized questionnaire, the Social Responsiveness Scale-Adult (SRS-A), to describe mother's social traits. BAP was defined as a SRS-A T-score ≥ 60. Regression analyses calculated associations between maternal BAP and risk of screening discordance.
Results:
Our sample included 819 mothers with data on relevant instruments. Seventy-nine mothers were BAP positive (9.6%) and 308 (37.6%) had discordance with clinical judgement. Mothers with BAP had 1.24 times the risk of discordance compared to mothers without BAP (95% confidence interval (CI): 0.96, 1.61, P= 0.1). Risk of over-reporting in mothers with BAP was 1.43 times that of mothers without BAP (95% CI: 1.08, 1.90, P=0.01). Under-reporting was less likely in the BAP group compared to the non-BAP group (RR=0.53; 95% CI: 0.17, 1.60, P=0.3), but not statistically significantly. Effect estimates were similar when a positive SCQ was defined as ≥15.
Conclusions:
Mothers with BAP were more likely to over-report child ASD symptoms on the SCQ and presence of BAP in the mother was not associated with under-reporting of ASD symptoms in the offspring. Further work will examine differences by child ASD severity and whether specific SRS-A domains are associated with screening discordance.

82 **142.082** Case Series of Subclinical ASD: Evidence Towards the Female Protective Effect

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Background: The sex ratio of males to females with ASD is 4:1. Females with ASD often have greater social communication weaknesses yet fewer restricted and repetitive behaviors than males (Rivet & Matson, 2011; Hartley & Sikora, 2009); however, recent evidence points to how current diagnostic criteria may miss females with ASD (Kirkovsk et al, 2013).
Objectives: We identified and characterized a subset of children who exhibited impairment in social functioning but did not reach the threshold necessary for an ASD. Their deficits were also not characterized by a different developmental or psychiatric disorder.
Methods: From a dataset of 1,626 children (793 females), ages 4-17, referred because of social communication deficits, 4 females and 1 male were identified who exhibited clear social and communication impairments, yet did not meet the threshold for a diagnosis of ASD based on criteria from gold standard diagnostic instruments and clinical judgment of highly expert clinicians. Social communication functioning was assessed using the Autism Diagnostic Observation Schedule (ADOS), Autism Diagnostic Interview, Revised (ADI-R), the Social Responsiveness Scale (SRS), the Social Communication Questionnaire (SCQ), and the Vineland Adaptive Behavior Scales-Second Edition (Vineland-II).
Results: Four females (.5%) and one male (.1%) from the overall dataset (N=1,626) presented with sub-threshold ASD symptoms. The females were between the ages of 6 and 12 years and of average to above average cognitive abilities (Full Scale IQ Range 92 to 118). The male was 9 years old and also exhibited average cognitive abilities (IQ = 97). The children had clear, yet either mild or inconsistent, social communication impairments. ADOS Total Scores (Module 3) ranged from 1-5, SRS T-Scores ranged from 53 to 90, and SCQ Total Scores ranged from 4-32, with a Total Score above 15 suggesting social impairments. Each individual had at least one measure within the range of clinical social communication impairment. Additionally, the children with completed Vineland Adaptive Behavior Scales (n =3) had highly significant impairments in adaptive functioning, with scores ranging from 61-68. Qualitatively, all of the parents reported noticeable difficulties with social verbalization, reciprocal conversation, and imaginative play due to limited flexibility.
Conclusions: A small but meaningful group of children exhibit sub-threshold ASD symptoms. This subclinical presentation is more common in girls than boys, despite the skewed sex ratio towards boys in ASD. These children with subclinical symptom presentation, particularly given the sex ratio, may provide information towards understanding the female protective effect.

83 **142.083** Categorical Meets Dimensional: A Fuzzy Categorical Conception of Autism Spectrum

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Background: Autism spectrum disorder (ASD) is presumed to have a categorical distinction from other disorders and the general population. Much current research, however, concentrates on testing whether ASD is better described by dimensional traits defined over continua. This oversimplifying dichotomy of "categorical vs. dimensional" obscures more finely graded possible alternatives, corresponding to structures that are neither purely categorical nor purely dimensional. In order to give a rigorous account of the nature of ASD, dimensional and categorical aspects of the disorder should be considered in a unified formulation.
Objectives: To demonstrate that a *fuzzy category*concept can better represent the ASD phenotype. A fuzzy category lacks sharp boundaries and is neither a discrete category nor a perfect continuum, including intermediate cases between those who are clearly affected and those clearly unaffected. In addition, we aim to show that an underlying ASD severity dimension can account for the heterogeneity and the overlapping nature of subcategories.
Methods: Our dataset consisted of 768 participants (678 males, 90 females): 554 children (age: 15.2 ± 3.3 years) with ASD (confirmed by a clinical expert using the ADOS and other assessments), and 214 typically developing children (TDCs) (age: 16.3 ± 3.2 years). A comprehensive phenotypic battery covered domains of social communication, language abilities, executive functioning, general intelligence, anxiety, attention, and hyperactivity. Using taxometric analyses, complex network analysis, and probabilistic inference with the phenotypic data, we defined the sample's categorical and dimensional characteristics. Finally, we attempted to validate those phenotypic results using brain connectivity analyses with a subset of the sample that had diffusion tensor imaging (DTI) data. 283 participants (239 male and 44 female) had diffusion imaging data (150 ASD and 133 TDC).
Results: The taxometric analyses suggested a categorical structure. Using complex network analysis, we identified communities of participants at multiple neighborhood scales, based on phenotypic relationship between participants. This yielded multiple communities including an intermediate one with a mixture of individuals from both ASD and TDC samples. The identified communities were not stable across different neighborhood scales, indicating heterogeneity and variations inside putative categories. Dynamics of community formation at different scales, revealed clear dimensional effects, with ASD severity regulating participant behavior in forming their communities. Neurobiological analyses, supporting our fuzzy categorical model, resulted in both categorical connectivity differences, and dimensional severity-related alterations.
Conclusions: We provided a computational portrait of ASD phenomenology, as described by phenotypic measures of multiple behavioral domains. Our results confirmed the intricate nature of ASD with categorical and dimensional aspects complementing each other. Even when we tried to identify putative categories in our sample, we saw clear dimensional effects, with ASD severity modulating phenotypic relationship between participants. Our neurobiological results further supported our hypothesis that ASD phenomenology can best be explained by a hybrid model, combining both categorical and dimensional structures. It should be noted, however, that our results are specific to our sample, which include those who met criteria for ASD via gold standard assessments and those who qualify as TDCs. Future work should include unselected clinical samples.

84 **142.084** Child and Parent Factors That Influence Social Communication Questionnaire Scores: An Examination of an English- and Spanish-Speaking Sample

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Background: The Social Communication Questionnaire (SCQ) is a frequently used screening tool for Autism Spectrum Disorder (ASD). Although the SCQ has been translated into several languages, including Spanish, the performance of the Spanish SCQ and factors that could influence SCQ scores have not been examined.
Objectives: The aim of this study was to examine whether child behavioral problems and parent characteristics (e.g., maternal education, language) influence the SCQ scores in a community sample of English and Spanish speaking caregivers.
Methods: This study included 104 English- and 96 Spanish- speaking caregivers, their child, and their child's teacher from a large suburban school district in Colorado. Caregivers completed the SCQ in English or Spanish and a brief demographics questionnaire; and the child's teacher completed the Behavior Assessment System for Children, Second Edition (BASC-2), Teacher Rating Scale (TRS) to assess child's behavioral problems.
Results: Simple and multiple linear regressions were used to determine how much variance in the SCQ is explained by maternal education or BASC-2 scores and whether language modified the relationship between maternal education or BASC-2 scores and SCQ scores. Whereas maternal education explained 9% ($F(1, 93) = 9.69$, $p = .002$) of the variance of the SCQ in the Spanish group, the BASC-2 explained 5% ($F(2, 101) = 5.62$, $p = .020$) of the variance of the SCQ in the English group. The English and Spanish groups were combined to explore the association between maternal education, language, and SCQ scores. Model 1 included maternal education and language, and model 2 included the interaction term (maternal education X language). In model 1, maternal education and language explained 3% of the variance in SCQ ($F(2, 195) = 3.45$, $p = .037$). In model 2, language modified the relationship between the maternal education and SCQ scores ($R^2 = .08$, $F(3, 194) = 3.98$, $p = .001$). That is, higher maternal education predicted lower SCQ scores.
Similarly, to examine the association between BASC scores, language, and SCQ scores, model 1 included BASC-2 scores and language, and model 2 included the interaction term (BASC-2 scores X language). In model 1, BASC-2 scores and language explained 6% of the variance in the SCQ ($F(2, 195) = 5.89$, $p = .003$). In model 2, although language explained 6% of the variance in the SCQ ($F(3, 194) = 4.05$, $p = .008$), language did not modify the relationship BASC-2 scores and SCQ scores.
Conclusions: Previous findings suggest that child and parental factors may affect ASD symptoms in school aged children. That is, maternal education and child behaviors were associated to SCQ scores in the English- and Spanish-sample, respectively. Learning about the performance of the SCQ in English and Spanish speaking families and factors that influence its scores can help clinicians and researchers decide when it is appropriate to use the SCQ and how to interpret SCQ scores in a diverse population.

85 **142.085** Cluster Analysis of Daily Living Skills in School-Aged Children with ASD

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Background: While daily living skills (DLS) are not a core symptom of individuals with autism spectrum disorder (ASD), they typically fall far below chronological age (e.g., Duncan & Bishop, 2015) and have been linked with factors such as language and cognitive abilities (e.g., Kanne et al., 2011). Studies have also found that internalizing and externalizing behaviors may predict DLS, which may in turn make it difficult to target the acquisition of these skills (De Bildt et al., 2005). It is critical to gain a better understanding of DLS profiles in children with ASD in order to determine how to develop interventions that effectively target these skills while also taking into account autism symptomatology, cognitive and language skills, behavior, and other factors.
Objectives: The primary aims of the current study were to (1) examine whether there are subgroups of children with ASD defined by both their Vineland-II DLS subdomain raw scores and language abilities and (2) explore the relationship between internalizing and externalizing symptoms on DLS subgroups.
Methods: The current sample included 959 children with ASD between the ages of 6 to 11 who participated in the initial baseline visit of the Autism Treatment Network, which is a registry collection of children with medical diagnoses of ASD across 14 sites in the United States and Canada. Inclusion criteria for the current study included the following: a completed Autism Diagnostic Observation Schedule (ADOS), a completed Vineland Adaptive Behavior Scales, 2nd Edition (Vineland-II) including DLS domain and 3 subdomains; a completed Child Behavior Checklist (CBCL); and demographic information on parental education, race, age, and gender. Due to limited data on cognitive abilities, the ADOS was utilized as a measure of functioning level. Specifically, children who received an ADOS Module 1 or 2 were classified as being in the *Low Language group* and children who received an ADOS Module 3 were classified as being in the *High Language group*.
Results: A five-cluster solution was found when utilizing age, ADOS module, and Vineland-II DLS domains. An examination of the means of the five clusters, found two groups with *Low Language*; *Low DLS* group (*n* = 143, 14.9%) and *High DLS* group (*n* = 170, 17.7%); and three groups with *High Language*; *Low DLS* group (*n* = 189, 19.7%), *Medium DLS* group (*n* = 254, 26.4%), and *High DLS* group (*n* = 203, 21.3%). The *High Language, Low DLS* group had significantly higher scores on the CBCL domains as compared to the other 4 groups.
Conclusions: Within the Low *Language* group, the *Low DLS* group has DLS that fall far below what would be expected based on their functioning level. Interestingly, the *Low Language, High DLS* group had better or equivalent daily living skills as compared to the *High Language, Low DLS* and *High Language, Medium DLS* groups. Age equivalent scores on the Vineland-II demonstrated the gap between age and functioning level, even for those with intact language skills (e.g., High Language, Low DLS group had age equivalents ranging from 3-5 years). Additional results and implications for intervention will be discussed.

86 **142.086** Comparing ASD Screening Measures for Toddlers and Preschoolers

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Background: With burgeoning waitlists for comprehensive diagnostic assessment of ASD, finding accurate methods and tools for advancing diagnostic triage becomes increasingly important. The current study compares the efficacy of three oft used paper and pencil measures, the Modified Checklist for Autism in Toddlers Revised with Follow-up (MCHAT-R/F), the Social Responsiveness Scale, Second Edition (SRS-2), and Social Communication Questionnaire (SCQ), to a novel measure developed by Cognoa, Inc. (Cognoa) using machine learning technology. Cognoa incorporates parent-report questions along with ratings of short video segments collected via parent smartphones and was designed to cover an age range from toddlers to preschoolers.
Objectives: To compare the sensitivity and specificity of four separate ASD screening measures in the same group of toddlers and preschoolers referred for a question of autism.
Methods: Data were collected from 230 children (*M* age = 40.3 months, *SD* = 14.9, range = 18.2 to 71.9) who were referred to one of three autism centers in the United States for a diagnostic question of ASD. Each participant completed the Cognoa screener and the other screening instruments (appropriate to age) prior to their scheduled appointment. Clinicians were blind to the Cognoa results. As part of a comprehensive developmental assessment, all participants completed traditional measures of cognitive abilities, adaptive functioning, and ASD symptoms (ADOS-2). Clinical Best Estimate Diagnosis was assigned based on DSM-5 criteria.
Results: Receiver operating characteristic (ROC) curves were plotted for each measure in their respective age groups along with sensitivity and specificity calculations. The results were as follows (at the suggested cutoffs for each measure): MCHAT R/F sensitivity = .87, specificity = .40; SCQ sensitivity = .63, specificity = .40; SRS-2-Pre sensitivity = .66. specificity = .42; SRS-2-SA sensitivity = .87, specificity = .26; Cognoa sensitivity = .75, specificity = .62.
Conclusions: Â Overall, Cognoa appears to have the strongest balance between sensitivity and specificity. This pattern remains in each measure's respective age group. For example, in the 18–30 month age range, Cognoa's optimal point was a sensitivity of .71 and specificity of .60 compared to MCHAT R/F's .87 and .40. Results suggest that combining traditional parent-report questions with clinician-scored video samples may result in improved screening performance for ASD. The current sample is a clinical population of 1.5 through 5 year olds all referred for a question of ASD; thus, the psychometric properties of the screening measures may be impacted by a greater presentation of symptomatology compared to a more general population sample (e.g., reduced sensitivity and specificity). Given that Cognoa spans the entire age range in question, and in the context of its relatively stronger and better balanced sensitivity and specificity, it may be more pragmatic for clinical use.Â A post-hoc revision of the Cognoa algorithm resulted in further improvements in sensitivity and specificity, particularly among younger children aged 18 to 30 months. Overall, results suggest that combining parent report and behavioral coding may result in improved performance in screening measures for ASD. Future studies are planned to prospectively evaluate the revised algorithm.

87 **142.087** Comparison of Behavioral Outcomes and Crisis Service Utilization Across the Six Specialized Inpatient Units in Phase I of the Autism Inpatient Collection (AIC)

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Background:
Children and adolescents with Autism Spectrum Disorder (ASD) are psychiatrically hospitalized at a much higher rate than non-ASD children Â due to serious emotional and behavioral problems including aggression, self-injury and tantrum-like behaviors. There is no comparative information, however, examining phenotypic differences, changes in serious problem behaviors, and use of crisis services, across specialized child psychiatry units.
Objectives:
Test for differences in demographic and clinical factors, patient characteristics, and site characteristics between six specialized child psychiatric units. Examine changes in child problem behavior over time (admission, discharge, and two month follow-up) both across the full sample and between sites. Examine changes in patients' use of crisis services two months prior to admission versus two months post-discharge.
Methods:
350 youth aged 4-20 years, with an ADOS-2 confirmed ASD diagnosis, admitted to specialized inpatient psychiatry units, were prospectively enrolled in the Autism Inpatient Collection (AIC) study, a six-site consortium investigating phenotypes, genotypes and behavioral outcomes among children. Parents completed measures at admission, discharge and two months post-discharge, and reported their child's demographics, problem behaviors (Aberrant Behavior Checklist – Irritability subscale, ABC-I), expressive communication and adaptive behavior (Vineland – 2), and crisis service utilization for the two months before and after hospitalization. Analysis of variance and chi-square tests were used to quantify site differences between subjects' demographic and clinical variables as continuous and categorical variables respectively. Paired t-tests were calculated to examine change in crisis services utilization over time. Changes in problem behavior over time were examined using multilevel model repeated measures analysis of covariance.
Results:
Site differences were found for children's ethnicity, race, non-verbal IQ, expressive communication, and hospital length of stay (see Table 1). There was a significant decrease in child problem behavior between admission and discharge for all sites, and slight increases in problem behaviors post-discharge, which varied by site. Improvement in problem behaviors, however, was not uniform across sites, even after controlling for significant site differences in our sample. There were also notable differences in the two subdomains of the ABC-I, tantrum-like behaviors (TLB) and self-injurious behaviors (SIB). SIB and TLB decreased while children were hospitalized, but we found an increase in TLB after discharge. Length of stay was the only statistically significant covariate in all models. Lower expressive communication scores predicted SIB but not TLB. We found an overall reduction in post-hospitalization utilization of crisis services for all sites combined. The decrease in emergency department visits and police contacts reached statistical significance at only three sites.
Conclusions:
Hospitalization in specialized child psychiatry units appeared to be effective in reducing the severity of child behavior problems from admission to 2-months post discharge for children and adolescents with ASD. Understanding the factors that contribute to variations in behavioral outcomes and crisis service utilization may enhance treatment for this population. Examining the comparative effectiveness of hospitalization in specialized units and general child psychiatric units, while matching for ASD symptom and behavioral severity in future studies would further inform public policy decisions on investing for services for this growing, high-need population.

88 **142.088** Conceptual Coverage of Vineland Adaptive Behavior Scales, Second Edition (Vineland™-II): Concept Mapping to a Patient-Centered Conceptual Model of Autism Spectrum Disorder (ASD)

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Background:
As new treatments for autism spectrum disorder (ASD) are developed, it is necessary that clinical outcome assessment (COA) measures used to measure treatment efficacy are both valid and reliable. To this end, health authorities recommend that COAs are evaluated for selection based on their content, specifically that instrument content should be aligned with a conceptual model of a disease or disorder.
The Vineland™-II, a measure of adaptive behavior from birth to adulthood, was recommended by a recent Autism Speaks expert panel as an appropriate measure of social communication deficits in ASD. The instrument is considered to have strong psychometric properties and high clinical relevance. However, to date, no study has critically evaluated the conceptual coverage of the instrument to an ASD-specific conceptual model.
Objectives:
The objective of this research was to evaluate the conceptual coverage of the Vineland™-II by mapping its content to a recently developed conceptual model of high functioning ASD.
Methods:
Items of the Vineland™-II Socialization, Communication and Daily Living Skills domains were mapped to a newly developed conceptual model of high functioning autism. The conceptual model (in press) was developed through an iterative process incorporating a review of qualitative literature and DSM-V Diagnostic Criteria, in-depth interviews with high functioning autistic individuals and their caregivers, and expert review. The conceptual model presents a visual summary of relevant symptom concepts, as well as the wider humanistic impacts and burden of ASD.
Results:
Concept mapping demonstrated that the Receptive, Expressive and Written sub-domains of the Vineland™-II Communication domain align closely with the core communication deficits of ASD included in the conceptual model. Moreover, Interpersonal Relationships, Play and Leisure Time and Coping Skills sub-domains of the Vineland™-II Socialization domain address concepts related to core socialization deficits. As expected, the Vineland™-II did not cover repetitive and restrictive behaviors. Concept mapping also showed that the Daily Living Skills sub-domains (Personal, Community and Domestic) of the Vineland™-II captures impairments in activities of daily living, identified as one of the most detrimental impacts of ASD. In addition, the Vineland™-II addresses some distal symptom concepts, namely cognitive functioning (for example, short-term memory and ability to follow instructions).
Conclusions:
Mapping of items of the Vineland™-II to a newly developed patient-centered conceptual model of ASD demonstrates that the Vineland™-II provides a comprehensive assessment of social communication deficits associated with ASD. Moreover, the mapping exercise demonstrates that the Vineland™-II also assess important concepts related to the broader impacts of ASD. These findings provide additional support that the Vineland™-II is a valid measure of social communication deficits for clinical trials in ASD.

89 **142.089** The Minimal Clinically-Important Difference (MCID) on the Vineland-II: Analysis of Data from 3,400 Individuals with ASD

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Background: Autism Spectrum Disorder (ASD) is associated with impairments in adaptive abilities in multiple domains including personal, social, and communication. Relative to age-matched peers, these impairments become increasingly pronounced across development, and are present regardless of comorbid intellectual disability. The Vineland Adaptive Behavior Scales, Second Edition (Vineland™-II) is the most commonly used instrument for quantifying these impairments but Minimal Clinically-Important Differences (MCIDs) on the Vineland™-II have never been established. Determining MCIDs for the Vineland™-II would facilitate the evaluation of new interventions for ASD, given the increasing use of the Vineland™-II in clinical trials.
Objectives: To generate anchor-based and distribution-based estimates of the MCID on the Vineland™-II adaptive behavior composite and standard scores for the socialization, communication and daily living subdomains.
Methods: We pooled data from several consortia/registries (EU-AIMS LEAP study, ABIDE-I, ABIDE-II, INFOR, Simons Simplex Collection) and clinical trials (Stanford, Yale, Roche). Quality control procedures were applied to the combined dataset (n>3,400 individuals), including the re-derivation of domain-level scores and outlier exclusion. The combined sample was stratified by age (children, adolescents and adults) and presence of comorbid intellectual disability (full-scale IQ < 70). Within each stratum, we adjusted for the fixed effects of age, gender, full-scale IQ, and the method of Vineland administration; we also adjusted for the random effect of dataset where possible. Two approaches were used to estimate the MCID: distribution-based methods and anchor-based methods. Distribution-based MCIDs include the standard error of the measurement, as well as one-fifth and one-half the covariate-adjusted standard deviation (both cross-sectionally [3,467 observations] and longitudinally [348 observations]). Anchor-based MCIDs include the slope of linear regression of CGI-S on Vineland score (630 observations), the slope of linear regression of CGI-I category on Vineland change (848 observations), the Vineland change score maximally differentiating minimal from no improvement on the CGI-I, the linking equation (Fayers & Hays, 2014), and equipercentile equating. Each MCID is reported separately, in addition to sample size-weighted averages for each MCID approach (anchor- vs. distribution-based).
Results: A Working Group was formed with representatives from Autism Speaks, Duke, King's College London, Roche, Simons Foundation, Stanford, and Yale.Â The first outcome was a consensus Statistical Analysis Plan (SAP) describing the QC process and methods for MCID estimation. At the time of writing, estimates of the Vineland™-II MCID individuals fall within the range of 1.83 to 4.67 points for the Vineland composite score across strata (d-MCID range: 1.83-3.15; a-MCID range: 2.05-4.67), with a trend towards lower MCIDs in the younger and intellectually-disabled populations due to increased variance among adults. MCIDs will be further refined as our pooled sample size increases.
Conclusions: Â Collaboration across academia, advocacy groups, and industry is critical to establishing a consensus on interpretation of clinical endpoints. Use of the Vineland™-II as an outcome instrument must take into account both the statistical and clinical significance of any observed change. Our ongoing analyses will inform the evaluation of new interventions for ASD by providing estimates of the Vineland™-II MCID across a wide range of ages and intellectual abilities.

90 **142.090** Age-Binned Normalization of Vinelandtm-II Increases Variability in Standard Scores: Implication for Clinical Trials in ASD.

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Background: Â Adaptive behavior is the performance of daily activities required for personal and social sufficiency. Autism Spectrum Disorder (ASD) patients' adaptive behavior is impaired, even in patients with normal or above normal IQ levels. The most commonly used instrument to measure adaptive behavior is the Vineland Adaptive Behavior Scales, second edition (Vineland™-II) which has been extensively used in ASD research and in clinical practice. More recently Vineland™-II has been used in clinical trials which aim to measure changes in adaptive behaviors over time. A given patient's raw score on the Vineland™-II scale must be adjusted for the score expected by the corresponding healthy control group of the same age. Importantly, the Vineland™-II manual provides normalization tables for these conversions for different *age ranges* (i.e., age 'bins') for the Composite score as well as for the Socialization, Communication, and Daily Living Skills domains scores. Thus, continuous raw scores are mapped onto discretized expected scores defined by categories of age ranges. Since both age and behavioral development are continuous variables, it is expected that this form of normalization will induce a certain amount of error, especially when a given patient's age deviates from the midpoint of the age bin. Moreover, additional error may be induced in change scores from clinical trials and longitudinal studies when patients move to an older age bin during the course of the study.
Objectives: To estimate the impact of the age binning on simulated clinical trial Vineland™-II change data and to develop a continuous normalization function for the age normalization.
Methods: Â The means of the 9 Vineland™-II raw-scores were extracted from the manual and interpolated with smooth splines to derive continuous estimates of the developmental trajectory. Then 1000 "average" study subjects (i.e. lying on the mean of the distribution) were simulated with an enrolment age randomly selected between 5 and 7 years. The standard domain scores were estimated for enrolment and 12 or 24 week assessments and the variances in the differences were estimated. By definition the difference should be 0 (i.e. effect of treatment was modeled) but as a result of age quantization, variance was induced that was set into relation to the variance observed in several studies that employed Vineland™-II.
Results: Simulations of 12-week long Vineland™-II clinical trial data with subjects aged 5 to 7 years showed that age binning increased variability of domain standard change scores by up to 2 units. Since the naturally occurring variation in domain change scores is as low as 6 standard scores in some clinical trials, this increase in variability corresponds to up to 12.5% of the variance. As expected, the continuous normalization function generated zero increase in change score variability in the simulated clinical trial data.
Conclusions: The use of Vineland™-II in clinical trials should take into consideration the increased variability introduced by the age binned normalization. Larger sample sizes should be considered to compensate for this higher variability. Alternatively, validation of continuous age normalization will improve the Vineland™-II use in clinical trials and observational studies.

91 **142.091** Vineland Adaptive Behavior Scale in Multicenter International Clinical Trials: Challenges and Solutions for a Successful Implementation.

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Background:
The assessment of adaptive functioning is critical in neurodevelopmental disorders (e.g., Autism Spectrum Disorder (ASD), Down syndrome (DS)). The Vineland Adaptive Behavior Scale, Second Edition (Vineland-II™) is the gold standard measure for assessing adaptive functioning. The Vineland-II™ is a complex clinical assessment that poses several challenges to the successful implementation in multicenter, international clinical trials. A rigorous rater selection and a standardized rater training program, linguistically validated translations including expert clinical review to assess cross-cultural appropriateness of item content, and specialized data management, are needed for the successful implementation of the Vineland-II™ in these studies. Because hand scoring is prone to error, use of the scoring software program is required. Procurement and merging of the Vineland-II™ output from multiple sites requires accurate processing of the files from the scoring software in a standardized manner to a central resource. The management of these data requires both sophisticated data management processes and expert clinical review to ensure data accuracy.
Objectives: Â Summarize challenges and solutions for the successful implementation of the Vineland-II™in multicenter, international clinical trials.
Methods: Â Data for this research are derived from Cogstate's implementation of rater training, data management, and monitoring of the Vineland-II™ in three pharmaceutical industry sponsored trials (one USA trial in ASD, one USA trial in Down syndrome, and one international trial in Down syndrome (USA, France, and Spain). Data from 596 Vineland- II™administrations from 140 raters across 47 sites were available for processing and review.
Results: To our knowledge, these data reflect one of the largest compilations of Vineland-II™data from industry sponsored clinical trials. A few sites implemented the software and data transfers without difficulty. Many sites had considerable difficulty using the software and transferring data accurately. Common problems included incorrect entry of date of birth, missing scores, incorrect application of basal and ceiling rules, and mislabeling of files for processing. Detailed metrics regarding the frequency of these issues and required site follow-up will be presented in the full poster.
Conclusions: By combining expert clinical review of Vineland-II data and specialized data management expertise, we implemented a process that resulted in the successful transfer and processing of nearly 600 Vineland- II™ administrations. Several important conclusions follow from this work. First, sites and CRAs require considerable training on the implementation of the Vineland-II™ scoring software to ensure accurate and timely data transfers. Second, clinical reviews need to be conducted on an ongoing basis during the study (e.g., identification of patterns of scoring for each patient population, review of outliers in data defined by 5th and 95th percentiles, and consistency of scores compared to other clinical assessments). Third, a clear process must be implemented to manage the scale-specific queries generated during the data reviews. Fourth, centralized data entry into the scoring program could be utilized instead of relying on site-level entry. Finally, our clinical quality assurance indicates that systematic efforts must be made to review data outliers, changes in raters across visits, unusual patterns of change scores, as well as identical scores across visits.

92 **142.092** Development and Testing of a Health-Related Independence Measure for Young Adults with Autism Spectrum Disorder

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Background: Health care transition (HCT) services assist youth in the transition from pediatric to adult care, promote health insurance retention, and encourage independence. The provision of HCT services is important to all youth but imperative for those with special health care needs such as Autism Spectrum Disorder. Unfortunately, less than a quarter of the 500,000 young adults with Autism Spectrum Disorder (YA-ASD) receive HCT services. Further, no measure of independence related to health care activities (health-related independence) exists for YA-ASD.
Objectives: This study created a Health-Related Independence (HRI) measure to evaluate YA-ASD's independence related to their health care needs and to promote successful transition to adult care.
Methods: A collaborative team of YA-ASD, caregivers, health care providers, and ASD-experts used a multi-stage, iterative process to develop the HRI measure. The first phase included focus groups with caregivers (7 groups with 39 total participants) and individual interviews with YA-ASD (27 participants 16-25 years old) to discuss transition needs and identify important HRI topics. Qualitative thematic analysis was used to identify 14 HRI themes (e.g. knowledge of condition, medication management, caregiver stress, safety, and sexuality).
Within phase two, the collaborative team ranked themes according to importance and frequency that young adults encounter these issues, outlined sub-themes, and created questions addressing each theme and subtheme. Exact language YA-ASD and caregivers used in the phase one interviews and focus groups and items from previously validated measures were used when possible. Two center wide meetings, at a local Autism diagnostic and treatment facility, were scheduled with clinicians, staff, and caregivers (n=30) to review, discuss, and develop specific questions and response options.
The third phase of this study involved cognitive interviewing and pretesting to evaluate specific questions, response options, and survey formatting. Fifteen caregivers participated in cognitive interviews examining 25 questions within the measure that the collaborative team considered to be especially complex. The final measure was pretested by twenty-one caregivers using a secure web-based survey tool, REDCap. Revisions to questions and measures were made iteratively based on participant data and team feedback.
Results: The final HRI measure includes 8 themes (60 items): Knowledge of medical/mental health conditions; Self-care; Medication management; Health care visits; Safety; Sexual health; Health care financing; and Goal planning. Initial qualitative data identified new HRI topics important to YA-ASD and caregivers. Cognitive interviews and pretesting identified problems with language, resulting in better item comprehension and improved response options.
Conclusions: The HRI measure is a self-administered measure of health care transition and level of independence of a unique and under-represented population- YA-ASD. This measure identifies their specific transition needs and will assist in developing tailored-interventions. The HRI measure will be full-scale tested at five ASD-specific clinics across the national in 2016-2017.

93 **142.093** Diagnostic YIELD of ASD Arena Assessment MODEL

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Background: An increasing number of young children are referred for assessment of possible Autism Spectrum Disorder (ASD). Access to initial diagnostic assessment for ASD or any developmental concern is poor in many regions, delaying time to diagnosis, and eventual treatment. In addition, not all children referred for possible ASD receive this as a final diagnosis. Our center redesigned our ASD/Developmental Concern diagnostic model for children under age 3 years, to improve access, and we also sought an improved understanding of the ultimate yield of ASD diagnosis for children under 3 referred for possible ASD or other developmental concern.
Objectives: (1) Determine diagnostic yield of arena assessments for children age 3 and under, referred for ASD or other developmental concerns; (2) Determine if ASD specific language in the referral modifies the likelihood of ASD diagnosis; (3) Assess average time to diagnosis.
Methods: Multidisciplinary arena assessment model for ASD or other developmental concern was tested and implemented (previously reported). Charts of 319 patients under 3 years of age (range 13-35 months), evaluated for ASD or other developmental concern between Jan. 2015 and May 2016 were reviewed for referral factors (referral reason, referring provider), and for final diagnostic determination. Time from referral to evaluation and final diagnosis were tracked as part of an ongoing Quality Improvement Initiative addressing access.
Results: 293 (91%) patients completed an evaluation for possible ASD or other developmental concern and were included in analysis. 116 patients (39.5%) received a final diagnosis of ASD, regardless of referral question. 189 patients (64.5%) had ASD specific language in their referral ("concern for autism", "MCHAT", "rule out autism"). Children with ASD specific referral language were more likely to have a final diagnosis of ASD compared to children without ASD referral language (46.6% vs. 26.9%; p=0.001).
Children not diagnosed with ASD received other developmental diagnoses, including global developmental delay (46.9%), language delay (23.2%), and behavior disorder (17.5%).
Average time from referral to evaluation was 20 days and time from referral to final diagnosis was 40 days.
Children referred who were age <24 months (n=226) were more likely to receive a diagnosis of ASD than those referred 24-36 months (42.5% vs. 29.9%)
Conclusions: Fewer than half of children referred for possible ASD received a final diagnosis of ASD, even when referral includes autism specific language. Children not receiving a diagnosis of ASD had other developmental concerns warranting intervention. Average time to final diagnosis was improved in our center through the development of a comprehensive arena assessment model, the addresses both possible ASD and other developmental concerns.

94 **142.094** Differences in the Behavioral Phenotype of Autism Spectrum Disorder in a Population Sample of Somali, White, Non-Somali Black, and Hispanic Children in Minneapolis

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Background: Previous research suggests that immigrant families from countries with a low human resource index are at increased risk for autism spectrum disorder (ASD) and have greater levels of impairment than other children with ASD (e.g., Barnevik-Olsson et al. 2008; Keen et al. 2010; Magnusson et al. 2012).
Objectives: Results are presented from a public health surveillance project in Minneapolis designed to determine if more Somali children had ASD than non-Somali children. A secondary goal was to identify differences in the behavioral phenotype of ASD across racial and ethnic groups; this is the focus of the present study.
Methods: A multi-step records review process was used to identify cases of ASD from educational and medical records of Minneapolis children who were 7-9 years old in 2010. Data documenting DSM-IV-TR autism symptoms, intellectual ability, and related behavioral and medical concerns were collected and used to characterize behavioral phenotype. Frequencies and percentages were used to describe DSM-IV-TR symptoms and associated features and were compared across Somali, white, non-Somali black, and Hispanic children with ASD. Categorical differences in ASD symptoms, cognitive level, and associated features across racial/ethnic groups were assessed with chi-square analyses for nominal data, and odds ratios with confidence intervals of 95% were used to estimate effect size. Differences in number of symptoms and features documented across racial/ethnic groups were compared using ANOVA as a metric of symptom severity.
Results:Â Somali children with ASD were far more likely to have intellectual disability (ID) than children with ASD in all other racial and ethnic groups. 100% of Somali children with cognitive data in their records had IQ ≤ 70 compared with 32.6% for the total sample. Regarding DSM-IV-based symptoms, Somali children were more likely than all other racial/ethnic groups to have lack of pretend play documented in their records and more likely than white and Hispanic children to have deficits in seeking to share enjoyment. Regarding restricted/repetitive behaviors, Somali children were more likely than Hispanic children to have preoccupations with parts of objects. Fixated interests were noted more frequently for white children than Hispanic children. White and Somali children were documented more often than Hispanic children with repetitive motor mannerisms. Somali and white children had a greater number of DSM-IV repetitive behavior symptoms documented in their records than Hispanic children, and Somali children were more likely to have co-occurring concerns of abnormalities in eating and drinking patterns than white and non-Somali Black children. In all cases, differences were no longer significant when the sample was limited to those with ASD+ID.
Conclusions: Results indicate a striking difference in the presence of ID in Somali children with ASD compared with other children. These results are consistent with previous research that found immigrants from low human resource index countries, and Somali children in particular, had higher rates of ASD+ID than other groups. Potential reasons for these findings and implications for practitioners will be discussed.

95 **142.095** Discordance Across Time in Caregiver Report during the Autism Diagnostic Interview-Revised (ADI-R): Findings from a Canadian Inception Cohort of Children with Autism Spectrum Disorder (ASD)

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Background: The ADI-R algorithms rely on accurate timing of the first manifestations of ASD symptoms. Caregiver recall of developmental milestones and the emergence of symptoms are thus key to an accurate diagnosis, especially when the evaluation occurs later in life. Previous studies in ASD found “telescoping” in caregiver report of language milestones, such that older ages of attaining milestones were reported as time passed (Hus et al. 2011). Several proposed factors influencing recall (Barsky, 2002; Hus et al., 2011; Jones et al., 2015) include characteristics of the informant (e.g., state at the time of recall, beliefs about etiology), the child (e.g., delays in development), and the interview (e.g., order of questions, time since the recalled event).
Objectives: In the present study we examined telescoping in caregivers’ longitudinal reports of their children’s early development in a prospective cohort study of children diagnosed with ASD. Specifically, we focused on ADI-R reports of age of first concerns, age of first words, and age of first phrases**.** We also examined possible moderators of telescoping including caregiver education level and child’s age and cognitive level at the time of diagnosis.
Methods: Data were drawn from Pathways in ASD, a study of 400 preschoolers followed across five Canadian sites. We included in the analysis cases for whom three longitudinal ADI-R interviews were available (n = 136 participants; 117 Males) and excluded cases for which caregivers either reported that their child had no functional language at study entry and/or possible/definite language regression at any point. ADI-R interviews were completed when the children were 2-4 years old (around time of diagnosis; mean = 46.6 months, SD = 7.9), 6-7 years old *(*mean = 79.8 months, SD = 4.0), and 10-11 years old (mean = 128.4 months, SD = 2.3). We explored as covariates: maternal education, child’s age of diagnosis (mean = 44.7 months, SD = 7.7), and the child’s cognitive ability measured with the Merril-Palmer-Revised (mean = 77.9 months, SD = 24.5) around the time of diagnosis.
Results: Â We found no telescoping effects in report of symptom onset; caregivers reported similar ages of onset across the three interviews. In contrast, we observed significant telescoping effects in reported age of language milestones. Over time, caregivers tended to report older ages of acquiring first words (p=.006) and first phrases (p<.001). We also examined potential moderators of telescoping. Caregiver reports of symptom onset over time did not interact with maternal education or with child age and cognitive ability around diagnosis. However, more telescoping of language milestones was evident in caregivers of children with lower cognitive ability (first words p=.01; first phrases p<.001). There were no significant interactions between report of language milestones over time and child’s age of diagnosis or maternal education.
Conclusions: Overall, our findings in a Canadian inception cohort replicate previous results of telescoping in caregiver-reported ages of language acquisition but not of first concerns. We will discuss implications of reliance on retrospective recall of information for clinical diagnosis and research, especially later in life.

96 **142.096** Does Anxiety Inflate Autism Severity Measures?

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Background:
Anxiety disorders are among the most common comorbid disorders in individuals with Autism Spectrum Disorders (ASD). Even amongst individuals who do not meet criteria for a comorbid anxiety disorder, symptoms of anxiety are common (e.g., Hartley & Sikora, 2009; Kim et al., 2000). A number of studies have found higher anxiety to be related to more severe symptoms of ASD, including social deficits (e.g., Dubin et al., 2015; Eussen et al, 2013) and repetitive behaviours (Rodgers et al., 2012). As a result of this relationship, some researchers have expressed concerns regarding the discriminant validity of measures of ASD and anxiety (Renno & Wood, 2013). Hartley and Sikora (2009) found that the DSM-IV social communication criteria were largely able to discriminate individuals with ASD from those with anxiety disorders. Conversely, Cholemery and colleagues (2014) found that the Social Responsiveness Scale showed poor discriminant validity in the identification of ASD versus anxiety symptoms. Overall, little research has examined the influence of comorbid anxiety symptomatology on severity of ratings assigned to individuals with ASD on other commonly used measures, such as the Autism Diagnostic Observation Schedule (ADOS) and the Childhood Autism Rating Scale (CARS).
Objectives:
The purpose of this pilot study is to report on an initial examination of the relationship between two autism measures and four indicators of anxiety.
Methods:
The data for this study came from a project evaluating the long-term outcomes of Intensive Behavioural Intervention (IBI). Twenty-one youth (13-20 years) diagnosed with ASD were reassessed after receiving IBI as children. Analysis for this study was conducted with a subsample who had complete data for four anxiety indicators (parent and youth ratings on Achenbach and SCARED) and two ASD measures (ADOS and CARS) (N = 15; M_{age} = 15.2).
Results:
The ADOS total score and the algorithm score for Social Communication and Repetitive Behaviours were weakly correlated with anxiety. The total CARS score was also weakly correlated with anxiety. Based on clinical cut-off scores on all anxiety measures, we dichotomized individuals in two groups (anxious vs. not anxious). We found no significant differences between the anxious and not anxious groups in terms of ADOS or CARS scores.
Conclusions:
Clinicians are often concerned regarding the overlap between symptoms of anxiety and ASD. For example, obsessive behaviours seen in anxiety disorders can sometimes look similar to repetitive or stereotyped behaviours. Thus far, there has been little research examining the influence of anxiety levels on the ADOS and CARS. The results from this pilot study indicate that the ADOS and CARS scores are not likely influenced by varying levels of anxiety. Given that these are well established and commonly used measures, it is promising to know that they are relatively independent of anxiety symptoms. However, this study was based on a small sample of high functioning and older individuals. Therefore, since ASD is greatly heterogeneous, more research is needed with a larger and more variable sample (i.e., varying levels of ASD severity and cognitive functioning).

97 **142.097** Does the Age of Diagnosis of Autism Contribute to Differential Cognitive and Behavioral Outcomes during Middle Childhood?

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Background: Early diagnosis of Autism Spectrum Disorders (ASDs) is now considered best practice so that children may access early intervention (EI) in a timely manner. However, the majority are diagnosed after 3-years.
Objectives: The aim in the current study was to establish whether the developmental outcomes at school age differ as a function of the age when children are diagnosed with ASD.
Methods: The cognitive, behavioural and adaptive outcomes of children diagnosed with ASD at 24-months (n=48) was compared to outcomes in a group of children diagnosed after 3-years and prior to school entry at 5-years (n=37). All children were aged between 7- to 9 years at follow-up.
Results: Children diagnosed early had received more intervention than those diagnosed later, and had significantly better verbal abilities and overall cognitive abilities at school age. A greater percentage of these children were in mainstream schools and significantly fewer received ongoing support compared to children in the late diagnosis group. However, no differences were found between groups in adaptive behaviour or autism severity scores at school age.
Conclusions: The findings support the importance of diagnosing ASD early, which maximizes children's opportunities to receive EI, leading to improved outcomes at school age

98 **142.098** EU-AIMS Clinical Network: Evaluating Sex- and Age-Related Differences in ADI-R and ADOS Scores in a Large ASD Sample

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Background: Developing a greater understanding of the sex-and age-related differences in the severity of the core symptoms of Autism Spectrum Disorder (ASD) has been impeded by small sample sizes, variation between samples in age and IQ of participants and large heterogeneity in symptom expression both between and within individuals. Large-scale samples are therefore necessary to better understand these relationships. In response, we set up a platform as part of the EU-AIMS clinical network to collaboratively pool data from major ASD clinical and research institutions across Europe. 22 sites situated in 10 different European countries have already shared demographic (e.g. sex, age, diagnosis and ethnicity), phenotypic (e.g. ADI-R, ADOS), behavioural (Vineland) and cognitive data (IQ) for secondary analysis.
Objectives: (1) To describe the current sample in relation to between-site variability in demographic and clinical measures and (2) examine differences in core ASD symptomatology between males and females with ASD on diagnostic instruments.
Methods: This preliminary sample is composed of 1386 participants (males = 1151, females = 235; 80% male-female ratio) ranging in age from 12 months to 30 years. Autism symptom data were obtained from the Autism Diagnostic Interview–Revised (ADI-R) total and domain scores (social, communication, and restricted/repetitive behaviour) and Autism Diagnostic Observation Schedule (ADOS) Calibrated Severity Scores (CSS). Linear mixed-effects models were used to investigate variability between sites in relation to demographic information (age and sex) and Intraclass correlation coefficients (ICCs) reflecting the ratio of between-site variance to total variance were calculated. For sex and age-dependent analyses, a random effect for site was included in all models to take into consideration the multi-level nature of the data, as well as to account for site heterogeneity across outcome measures.
Results: Overall, there were significant site effects on all demographic and core characterisation measures reflecting the variable recruitment pattern across multiple sites and countries. While these site effects were very pronounced for age of participants (*ICC*=.67), they were less so for sex ratio (*ICC*=.02) and only moderate for core ASD symptom measures (e.g. ADI-R domain totals: all *ICC* <.20). On the core ASD measures, no significant effects of age or sex were found for ADI-R Social and Restricted, Repetitive and Stereotyped Behaviours and Interests (RRB) domain total scores (all p >.3). However, females scored significantly lower than males on the Communication domain, $x^2(1) = 5.78$, $p = .016$, $d = .24$. Effects of age and sex on ADOS CSS Total, Social Affect and RRB will also be reported.
Conclusions: Pooling datasets across European clinical and research sites as part of EU-AIMS will help to establish a valuable resource for ASD research in Europe. In the future, this resource will not only boost research capacity, but also improve transparency, openness and research efficiency of autism research in Europe.

99 **142.099** Effectiveness of Screening Tools in a Community-Based Sample: Which Children Are Missed and Why?

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Background:
Early screening of Autism Spectrum Disorder (ASD) is essential for referring children for evaluations and early intervention, with benefits found in starting intervention as young as possible (Zwaigenbaum et al., 2015). With pediatricians on the front lines, providers are in need of measures that efficiently and effectively identify concerns. The Ages and Stages Questionnaire-3 (ASQ-3) is a common developmental screener for general developmental concerns and the Modified Checklist for Autism in Toddlers, Revised (M-CHAT-R) is a widely used autism specific screening tool. Our previous work has shown that parent concern on the ASQ accurately captures developmental delays in children with ASD, but that only the communication scale was associated with autism symptomatology on an ADOS, suggesting the need for an ASD specific screener as well (Hamner et al., 2015).
Objectives:
To build upon our previous work by evaluating two commonly used screening tools and their effectiveness in identifying children in need of further evaluation.
Methods:
78 children (64 boys) between the ages of 16-43 months (mean = 28.80 months, SD = 6.93) referred based on parent concerns and/or provider recommendations who received an ASD diagnosis. Approximately 85 additional participants are expected before May 2017. Parents completed the ASQ-3 and M-CHAT and children were administered the Mullen Scales of Early Learning and the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2).
Results:
On the ASQ, 63 out of 78 children failed the communication scale (81%), 58 (74%) failed the problem-solving scale, and 56 (72%) failed the personal-social scale. Of the 15 children who passed the communication scale, 6 more were identified by either the problem-solving or personal-social scales. On the M-CHAT, 66 (85%) screened with concerns (total score 3 or higher), of which 61 also failed at least one ASQ scale. When combining the ASQ communication scale and the M-CHAT, 72 (92%) of children were identified and combining an ASQ fail on any scale and the M-CHAT increases that number to 96%. Children who passed the ASQ communication scale performed significantly higher on Mullen visual reception ($t(77) = 4.56$, $p < .01$), receptive language ($t(77) = 5.44$, $p < .01$), and expressive language ($t(77) = 4.37$, $p < .01$) scales. A similar, significant pattern was seen for problem-solving and personal-social scales. Additionally, those who passed the communication scale were significantly older ($t(77) = 2.80$, $p < .01$); this pattern was not seen on other scales. Children missed on the M-CHAT had significantly higher visual reception scores ($t(76) = 2.04$, $p < .05$) and a trend for higher expressive language scores ($t(76) = 2.01$, $p = .06$).
Conclusions:
In our community sample, both the ASQ and M-CHAT flagged the majority of children with ASD, supporting the utility of these measures in pediatric practices. The most children were identified with the combination of ASQ scales and the M-CHAT, indicating a need for both measures. Higher functioning children are more likely to be missed when using only one of the measures. Pediatricians are encouraged to monitor parent concerns in children without developmental delays even if passing screening measures.

100 **142.100** Evaluation of a Training Workshop to Enhance General Pediatrician Diagnostic Skills for Autism Spectrum Disorder

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Background: The increase in autism spectrum disorder (ASD) diagnoses over the past decade has placed strain on access to ASD diagnostic assessments. One potential way to improve diagnostic capacity is through training general pediatricians to provide ASD diagnoses in their practices.
Objectives: The objective of this work was to evaluate a workshop designed to enhance ASD diagnostic abilities among general pediatricians, specifically evaluating whether participants changed their practice and their motivation for practice change.
Methods: Twenty-four general pediatricians attended a workshop that was designed to teach skills in: assessing for ASD (including history/observation and interaction); communicating the ASD diagnosis through in situ simulation with actors playing parents; connecting families to resources; and billing effectively. Further ongoing mentorship was also available in the six months after the workshop for participating pediatricians. A web-based survey was sent out to all participants before the workshop to provide information on attendees and six months after the workshop to determine the impact of the workshop on their practice. Eight participants were also interviewed by a researcher who was not part of the workshop. Interviews were transcribed, coded, and reviewed by study team to determine whether the workshop achieved its objectives.
Results: Prior to the workshop, 15 of the 23 respondents (65.2%) performed ASD diagnostic assessments in their practice. Fifteen participants completed the six-month post-workshop survey (62.5% response rate); of these, 80% (n = 12) performed ASD diagnostic assessments. Among the six-month post-workshop survey respondents, 43% of participants agreed or strongly agreed with feeling confident diagnosing ASD prior to the workshop; after the workshop, this increased to 67%. Analysis of the eight in-depth interviews grouped participants into three categories: 1) Participants who were already diagnosing ASD in their practices (5 of the 8 participants interviewed); 2) Participants who started diagnosing ASD as a result of attending the workshop (2 of the 8 participants interviewed); and 3) Participants who continued not diagnosing ASD after the workshop (1 of the 8 participants interviewed). Participants who already diagnosed ASD prior to the workshop still ascribed value to attendance. The workshop increased their feelings of confidence, let them know that their peers were also diagnosing ASD, gave them approval from experts for their practice, and gave them direct access to experts. The two participants who started performing ASD assessments after attending the workshop described a change of perspective about whether ASD diagnosis was a “reasonable” part of their practice. They felt empowered to be able to help families access resources faster. One participant did not perform ASD diagnoses before or after the workshop. This participant still did not feel comfortable communicating the ASD diagnosis to the family.
Conclusions : For general pediatricians to start doing ASD diagnoses in their practices, they need to feel that this change is reasonable and supposed by both peers and experts. Attitudes towards ASD play a big role, particularly as they relate to communicating the ASD diagnosis to families.

101 **142.101** Examining Agreement in Parent and Teacher Report for School-Aged Children at-Risk for Autism Spectrum Disorder

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Background: Â Parents and teachers are frequently asked to provide information about a child's emotional, behavioral, and social functioning when there is a question of possible Autism Spectrum Disorder (ASD). Two commonly used measures include the Achenbach Child Behavior Checklist (CBCL) and the Social-Responsiveness Scale, Second Edition (SRS-2). Parent and teacher report are important factors when considering a possible ASD diagnosis for school-age children. Therefore, it is important to understand the relationship between reports from these informants.
Objectives: Â To examine the relationship and inter-rater consistency (ICC) between parent and teacher report for a sample of children at-risk for ASD.
Methods: Â Data for this study is from the South Carolina Children's Educational Surveillance Study (SUCCESS), which is designed to assess the prevalence of ASD through direct screening and evaluation.Â Children born in 2004 and aged 8-11 at the time of participation were identified as being at risk for ASD via population-based screening using the Social Communication Questionnaire (SCQ). Children at-risk for ASD received full developmental assessments to determine diagnostic status (n=292). For the majority of children (n=247), both parents and teachers completed questionnaires including the SRS-2 and the Achenbach Child Behavior Checklist (CBCL). Data analyses included parent versus teacher predicted means via mixed model approach and estimated ICC.
Results: In the total sample of children at-risk for ASD, both the Social Communication Index (SCI) and Total Score of the SRS-2 were rated higher by parents than by teachers (LSM difference 6.27 (SE=0.87); $p < .0001$; 6.09 (SE=0.87); $p < .0001$, respectively). ICC was fair for the SCI (0.39) and moderate for the Total Score (0.42). Significant differences in parent and teacher ratings on the SRS-2 were observed in children both with and without the diagnostic classification of ASD. In the total sample, parents also rated children higher in internalizing problems on the CBCL (LSM difference 4.42 (SE=0.88); $p < .0001$, and ICC was fair (0.23). However, no significant differences were found between parent and teacher report of externalizing problems on the CBCL. Among children who screened at-risk but were not diagnosed with ASD (n = 202), parents also rated children higher in internalizing (LSM difference 5.16 (SE=0.96); $p < .0001$) and externalizing problems (LSM difference 1.85 (SE=0.83); $p=0.027$) on the CBCL. However, among children diagnosed with ASD (n = 45), there were no significant differences between parent and teacher report on internalizing or externalizing behaviors on the CBCL. ICCs were fair for both internalizing (0.20) and externalizing problems (0.37).
Conclusions: Results suggest that, on average, parents are more likely to endorse social communication concerns than teachers. Parents also endorse more internalizing and externalizing behavior problems among children who are at-risk but do not go on to be diagnosed with ASD, while there is greater agreement between parents and teachers on these scales for children subsequently diagnosed with ASD.

102 **142.102** Examining Measures Used for the Diagnosis of Autism Spectrum Disorder

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Background:
To date, there is no known biological marker for Autism Spectrum Disorder (ASD) (Huerta & Lord, 2012). Thus, in order to formulate a diagnosis, clinicians often use various standardized measures to gather information from parents and the child (Charman & Gotham, 2013). However, across the literature, there are inconsistent results with regards to agreement between measures and classification systems used for the diagnosis of ASD. For example, some have found that the Childhood Autism Rating Scales (CARS) is more conservative in comparison to the Autism Diagnostic Schedule (ADOS) (Reszka et al., 2014), while others have found that there is good agreement between these two measures (Ventola et al., 2006). Furthermore, there are mixed findings in the literature on the agreement of these measures in relation to the 4th and 5th editions of the DSM (Perry et al., 2005; Taheri et al., 2012). Additionally, in a systematic review, it was found that only 50 to 75% of individuals maintained ASD diagnoses with the shift from the DSM-IV to the DSM-5 (Smith et al., 2015), calling into question the agreement of these diagnostic methods.
Objectives: The purpose of this study was to examine the agreement among two commonly used observational measures (ADOS and CARS) and the DSM ASD criteria (4th and 5th edition). In addition, we explored ASD diagnosis for each measure in relation to child characteristics (i.e., cognitive and adaptive level).
Methods: The data for this study came from a research project evaluating the long-term outcomes of Early Intensive Behavioural Intervention (EIBI). Twenty-one youth (aged 13-20 years) diagnosed with ASD were reassessed after receiving EIBI as young children (ending approximately 10 years ago). The assessment battery consisted of four ASD diagnostic measures (CARS, ADOS, DSM-IV and DSM-5 criteria), and standardized measures of cognitive and adaptive functioning.
Results: In terms of percentage agreement between diagnostic measures, there was low agreement on most measures, with agreement for an ASD diagnosis being best between the DSM-IV and ADOS (86%), and agreement for a non-diagnosis being best between the DSM-5 and the CARS (67%). Chi square tests revealed that ratings on most of the measures (i.e. DSM-5 and ADOS; DSM-IV and CARS; DSM-IV and DSM-5; DSM-IV and ADOS; and ADOS and CARS) were independent of each other. In addition, those diagnosed with ASD on the CARS and DSM-IV had a significantly lower IQ and adaptive behaviour.
Conclusions: There are a number of research implications of this study. Changing definitions of Autism in research affects the whole knowledge base regarding Autism and ASD more broadly. Further, inconsistencies amongst measures can impact ASD prevalence reports in the literature, depending upon which assessment and classification system is used. It is concerning that there is not high agreement among various diagnostic measures, which may impact accessibility to suitable treatments or interventions. With inconsistencies amongst measures, clinical judgment is required more than ever when making the diagnosis of ASD.

103 **142.103** Examining Symptoms of Autism Spectrum Disorder in Children with Prenatal Drug Exposure

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Background: Newborn infants exposed to maternal drug use in utero often experience neonatal abstinence syndrome (NAS) characterized by symptoms of drug withdrawal shortly after birth. Infants with NAS are at an increased risk for language delays, inattentive behaviors, hyperactivity, and social-emotional problems in early childhood (Hunt et al., 2007;Logan et al., 2012; van Baar et al., 1994). The behavioral phenotype associated with NAS overlaps with symptoms observed in Autism Spectrum Disorder (ASD) including impairments of social-communication, withdrawal, and emotional dysregulation. Despite behavioral similarities in children with NAS and ASD, little is known about how symptoms of ASD present in children with NAS. It is important to identify populations that may be at-risk for ASD in order to inform differential diagnosis and treatment practices.
Objectives: The present study aims to examine symptoms of ASD in children with NAS. Developmental and behavioral profiles will be compared in children with NAS that meet and do not meet diagnostic criteria for ASD.
Methods: Participants consisted of 76 children that received a medical diagnosis of NAS in infancy and subsequently present to the Child Developmental Center at a tertiary care hospital between the years 2010-2016. Participants were categorized into two groups: children who received a diagnosis with ASD and NAS (N = 36) and children with NAS who did not receive an ASD diagnosis (N = 40). This retrospective chart review study enables the characterization of presenting problems, referral patterns, developmental trajectories, as well as psychological test results examining cognition, language, social communication, repetitive and restrictive behaviors, adaptive and broad behaviors for those who received interdisciplinary team evaluation for ASD. Specifically, the Autism Diagnostic Observation Schedule (ADOS), Autism Spectrum Rating Scale (ASRS), and Childhood Autism Rating Scale (CARS) were used as measures of autism symptomology. Developmental functioning was assessed using the Mullen Scales of Early Learning (MSEL) and behavioral symptoms were assessed using the Child Behavior Checklist (CBCL).
Results: Of the 76 children diagnosed with NAS that were evaluated for ASD, 47% met diagnostic criteria for ASD at a hospital-based child development clinic between the years 2010-2016. Trend analysis reveals an increase in NAS, which elevates the need to understand the relationship between NAS and ASD in future efforts to ensure screening and early identification in populations particularly at risk. Overall, preliminary results from this study indicate specific behavioral patterns of social-emotional and developmental outcomes in children with NAS and ASD.
Conclusions: NAS is associated with a unique behavioral phenotype in early childhood that often overlaps with symptoms observed in ASD. In the current study, we found that almost half of the children with NAS evaluated for Autism Spectrum Disorder met diagnostic criteria for ASD suggesting that infants with NAS are at-risk for pervasive developmental and behavioral problems. It is important to examine how behavioral symptoms emerge and present in children NAS in order to gain a better understanding of how different etiological pathways may result in similar behavioral profiles associated with ASD. Future efforts include the establishment of a rural outreach clinic to track the children at-risk for NAS given prenatal drug exposure.

104 **142.104** Executive Function in Preschoolers with ASD: Evaluation of a Test Battery with Minimal Verbal Demands

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Background: Executive Function (EF) refers to a set of cognitive processes that regulate impulses and emotions and channel them into socially appropriate, goal-directed behavior. Core EF processes include working memory, inhibition, and shifting (Diamond, 2013). Impaired EF is linked to a number of poor outcomes in school-age youth and adults with autism spectrum disorder (ASD), including lower adaptive behaviors, more repetitive behaviors, and poorer social skills (Yerys et al, 2009; Pellicano, 2012). Less is known about EF in the preschool years, as few standardized measures have been validated in children of this age with developmental delays.
Objectives: This study evaluates the feasibility and reliability of an EF battery that places no expressive verbal demands and minimizes the need for receptive verbal skills in preschoolers with ASD.
Methods: A total of 56 preschoolers with ASD (mean age=51.6 months; 80% male) completed a 20-minute EF battery that included putative measures of inhibition (Balance Beam Task, Tongue Task, and NEPSY-II Statue Subtest), working memory (Leiter-3 Memory Subtests), and shifting (Spatial Reversal Task). To evaluate feasibility, completion rates were calculated for each measure, as the percentage of children who were willing and able to complete the task and demonstrated understanding of task instructions. The role of developmental functioning (according to the Mullen Visual Reception Age Equivalent (VRAE)) on task completion and performance was also evaluated. Task order was counterbalanced to account for possible order and fatigue effects in the battery. The battery was re-administered to 16 children within two weeks from the initial administration, and intraclass correlations (ICC) were calculated to measure test-retest reliability.
Results: Regarding feasibility, only the Spatial Reversal Task had a successful completion rate greater than 80% for the entire sample (i.e. <20% were unable to complete the task or scored a zero). However, completion rates were at least 80% for Tongue Task when VRAE from the Mullen was at least 19 months (n=20) and for Leiter-3 Forward Memory Subtest when VRAE was at least 14 months (n=38). The Balance Beam and Statue tasks demonstrated very poor feasibility in this sample. For the 16 children who were retested, completers versus non-completers were consistent across time for Spatial Reversal, Tongue Task, and Forward Memory (ICC>.75). Performance reliability was also acceptable for total correct responses on Spatial Reversal (ICC=.73) and excellent for the Tongue Task and Forward Memory (ICC>.90).
Conclusions: EF is an important aspect of cognition to accurately measure in ASD because of its strong relationship with several important outcomes in older children and adults with ASD. This study provides initial evidence for the feasibility and reliability of a preschool EF assessment that minimizes verbal demands, along with potential developmental age guidelines for administration. This study suggests that a valid preschool EF battery that is sensitive to delayed cognitive development is attainable.

105 **142.105** Feasibility of Wh-Question Test in NT and ASD

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Background: Children are presented with a multitude of questions encompassing all wh- question forms *(e.g., what, who, when, where, why* and *how)* in daily life. Those who have difficulty comprehending the meaning of these questions likely encounter a significant number of communication breakdowns throughout their day. It has been observed that individuals with Autism Spectrum Disorder (ASD) have specific difficulty in comprehending and responding to wh- questions (Goodwin, Fein & Naigles, 2012; Doggett, Krasno, Koegel & Koegel, 2013; Secan, Egel & Tilley, 1989). This difficulty is potentially attributed to factors including overall language delays or difficulty regarding the pragmatics of asking and responding to questions, among many other factors. While this particular difficulty has been observed in individuals with ASD (Doggett et al., 2013, Goodwin, Fein & Naigles, 2015; Goodwin, et al., 2012; Secan, et al., 1989; Tager-Flusberg, 1999), there is a lack of engaging assessment tools to identify the wh- question forms with which a child has difficulty and the error patterns showing the strategies these children are using. The lack of a comprehensive assessment tool impinges upon Speech Language Pathologists and educators in their design of appropriate goals for intervention.
Objectives:
The study was conducted to assess 1) the feasibility of administrating a computer based Wh-Question assessment to identify language goals in NT and ASD elementary school children 2) whether error patterns were different in the two groups.
Methods:
The Wh- Question Test is a computer program that assesses the question forms of *who, what, where* and *when* with multiple-choice responses presented through verbal and visual stimuli. The test contains 10 unique contextual sentences, each with an accompanying illustration, and a corresponding *who, what, where,* and *when* question, resulting in 40 total questions. Each contextual sentence includes a subject, transitive verb, object, location and time; therefore, all information needed to answer each question form is provided in the contextual sentence.
Example item:
'The children played with blocks in the classroom before music.'
Question: 'What did they play with?'
a) blocks
b) before music
c) the children
d) drums
e) in the classroom
The program collects both accuracy as well as error type.

Group	Mean Age	N	SD	Minimum Age	Maximum Age
NT	6.54	41	0.977	5	8
ASD	8.81	16	1.515	6	10

Figure 2. Participants
Results:
A mixed model between group (2) within wh- question form (4) ANOVA a significant interaction was present between wh- question form accuracy and group (ASD or NT) ($F=6.657$, $p=0.001$). 'When' questions were most difficult for both groups, but especially for the ASD group.
Conclusions:
The Wh-Question test is a feasible and engaging way to assess Wh-Question comprehension in both NT and ASD elementary school age children. Both groups showed similar patterns of difficulty, but the ASD group showed more difficulty relative to the NT group especially for 'When' questions.

106 **142.106** Gender Differences in Children and Adolescents with High-Functioning Autism Spectrum Disorders

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Background: It has been proposed that there is a distinct female phenotype for Autism Spectrum Disorders (ASD) which leads to a number of females on the spectrum being diagnosed later than males or missed completely (Lai et al. 2015). This hypothesised phenotype states that: (1) females are more likely to adopt camouflage strategies to mask or compensate for their autism; (2) females are more socially motivated and consequently make more effort to establish friendships; (3) females are more likely to have internalising difficulties (anxiety, depression) which go unnoticed; (4) that females are more likely to have restricted and repetitive interests that are "relational" in nature, i.e., involve developing and maintaining relationships with others. These "others" could be animals; they could be real people including celebrities; they could be imaginary friends or fictional characters (Attwood, 2006).
Historically the development of gold-standard ASD assessment measures has relied upon predominantly male samples, causing them to have a male-centric understanding of how ASD presents. As such, current assessment measures for ASD, such as the Autism Diagnostic Schedule Observation (ADOS), are thought to fail to capture the hypothesised female ASD phenotype.
Objectives: To develop and pilot a coding frame, the Gendered Autism Behaviour Scale (GABS), which can measure the female ASD phenotype from videoed ADOS sessions.
Methods: 18 GABS items were developed based on current understanding of the female phenotype for ASD using a combination of research evidence and expert-clinician experience. ADOS Module 3 and 4 assessment recordings were then coded using the GABS to compare males (n=22) and females (n=22) with ASD aged between 9 and 15 years. Inter-rater reliability was evaluated using the Kappa statistic, and two-tailed Fisher's exact tests were carried out to compare GABS item scores for males and females.
Results: The GABS had acceptable inter-rater reliability with an average Cohen's kappa of .65. The reporting of camouflaging in ADOS interviews was very low across the genders with only 3/22 males and 5/22 females showing evidence of camouflaging and no significant differences were found. Whilst there was no difference between females and males in terms of the intensity of their focus interests, there was a gender difference in the nature of these interests: females were more likely to talk about relational interests, in particular, animals, whereas males described more non-social interests ($p<.001$). Females also reported higher degrees of internalising difficulties ($p<.05$) and being more affected by social acceptance and rejection than males ($p<.05$).
Conclusions: Preliminary findings indicate that the GABS is a reliable instrument for assessing gender differences in standard ADOS Module 3 and 4 assessments. It revealed significant differences in how males and females with ASD present, especially in terms of the nature of their restricted and repetitive interests and their social motivation. ASD measures should cover areas such as camouflaging and relational interests so as to improve early and accurate diagnosis and support for females with ASD.

107 **142.107** High Autistic Traits in Women with Eating Disorders

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Background:
An increasing body of literature has demonstrated a degree of comorbidity between Autism Spectrum Disorders (ASD) and various eating disorders (EDs) in females, but little is known about the relationship EDs have with ASD, and what effect an ED has on the detection and diagnosis of ASD.
Objectives:
The current study aimed to evaluate whether females with high autistic traits were likely to receive a diagnosis of an ED, which may serve to obscure their potential diagnosis of an ASD. It was hypothesised that women with high autistic traits would be undiagnosed with ASD in many cases, and would instead present with a diagnosis of an ED.
Methods:
Using an online data collection method, 670 women over the age of 18 were recruited through social media and specialist ASD and ED support services. The women completed two screening measures: the Autism-Spectrum Quotient (AQ) and the Eating Attitudes Test (EAT-26).Â Participants were classified as either 'high' or 'low' on specific variables based on established cut off scores for these instruments, and designated the following labels: high autistic traits (HATs); low autistic traits (LATs); high eating disorder traits (HEDs); low eating disorder traits (LEDs).
Results:
Of all 670 participants, 21.5% were classified as HATs and 78.5% as LATs, while 24.0% were classified as having HEDs and 76.0% as having LEDs. Of the total, 16.7% reported having received a diagnosis of ASD, and 21.7% reported having received a diagnosis of an ED. Fewer women with HATs were diagnosed with ASD than with an ED (Z=3.33, p<0.001). When asked if they had symptoms typical of an eating disorder, 49.3% responded that they had. Women with HATs (diagnosed & undiagnosed) were significantly more likely to also display HEDs than LEDs ($\chi^2_{(1)}$=24.31, p<0.001). Women with a diagnosis of ASD, compared to those without, were significantly more likely to display HED traits ($\chi^2_{(2)}$=22.21, p<0.001). However, women with HATs but no diagnosis of ASD, were not more likely than those with LATs to receive a diagnosis of ED ($\chi^2_{(2)}$=0.43, OR=1.3 95%CI [0.623, 2.580], p=0.32). Participants, who were otherwise undiagnosed, but displayed high traits of ASD, were not more likely to have been diagnosed with an ED. Last, women with an ED were significantly more likely to be in the HATs group than women without an ED ($\chi^2_{(2)}$=16.16, p<0.001).
Conclusions:
The results support the conclusion that women with HATs are more likely to be diagnosed with an ED than ASD. While it may appear that this diagnosis may obscure a diagnosis of ASD, preventing early intervention, the finding that those lacking a diagnosis but having HATs were not more likely to receive a diagnosis of an ED, suggests that an ED diagnosis does not preclude or camouflage a diagnosis of ASD. Nonetheless, the high rate of ED traits in women with ASD reflects the obsessional nature and desire for environmental control that is frequently found in ASD.

108 **142.108** How Can We Assess the Broader Autism Phenotype More Systematically? Insights from a Multiple Measure Study

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Background: Â Research examining the Broader Autism Phenotype (BAP), or subclinical autistic traits, among emerging adults suggests that the BAP is characterized by difficulties understanding one's own and others' emotions and perspectives, reduced prosocial behavior and emotional intimacy, sensory atypicalities and enhanced creativity (Austin, 2015; Brewer et al., 2015; Best et al., 2015; Gokcen et al., 2014; Jameel et al., 2014; 2015; Jobe & White, 2007). Although most of the aforementioned studies relied upon self-report measures, none of them assessed susceptibility to the social desirability bias. This is problematic because the BAP is associated with reduced understanding of social pretense (Yang & Baillargeon, 2013). In addition, prior research has typically not used a range of measures to determine which characteristics remain associated with the BAP when other characteristics are controlled for or examined if associations are apparent with more than one BAP measure.
Objectives:

1. To examine if the BAP is associated with reduced social desirability bias.
2. To obtain a more comprehensive characterization of the BAP using multiple measures.

Methods: College students (N = 391; 18-25 years old) completed an online survey that included measures of autistic traits, the Autism Spectrum Quotient (AQ) and Social Responsiveness Scale (SRS-2), the sensory subscale of the Ritvo Autism and Asperger Diagnostic Scale, the Basic Empathy Scale, the Toronto Alexithymia Scale, the Marlowe-Crowne Social Desirability Scale, and a Divergent Thinking task. We also examined self-reported prosocial behaviors using scenarios Jameel and colleagues (2014; 2015) developed to demonstrate that heightened autistic traits were associated with reduced self-reported prosocial behaviors across 10 contexts. To avoid carry-over effects, we randomly assigned participants to two groups using a between-subjects research design. Scenarios presented as ambiguous (e.g. help a young man) for one group of participants were presented as clear-cut (help an old lady) for the other group and vice versa.
Results: The AQ and SRS-2 were positively correlated with each other, r(389)=0.499, p<0.001. Social desirability scores were inversely correlated with the AQ, r(389)=-0.15, p=0.003 and the SRS-2, r(389)=-0.37, p<0.001. In a linear regression predicting AQ scores, reduced cognitive empathy and heightened alexithymia (ps<=0.001) were associated with autistic traits; sensory atypicalities, affective empathy, social desirability, creativity, and prosocial behaviors were unrelated to the BAP. In a linear regression predicting SRS-2 scores, reduced cognitive empathy and social desirability and heightened alexithymia and sensory atypicalities were associated with the BAP (ps <0.001); creativity, prosocial behaviors, and affective empathy were unrelated to SRS-2 scores.
Conclusions: Â Findings indicate that reduced social desirability is associated with the BAP but prosocial behaviors are not consistently associated with the BAP. The concurrent measurement of multiple potential BAP constructs provides insights about what is central to the BAP. Difficulty understanding one's self and others is a consistent aspect of the BAP in emerging adulthood; difficulty understanding others is also part of the BAP among schoolchildren (Tsang et al., 2016). Findings highlight the importance of assessing social desirability and multiple potential aspects of the BAP when using self-report measures.

109 **142.109** How Certain Are Clinicians in Determining Outcome Diagnoses in 2 Year-Olds?

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Background:
Clinicians have become increasingly more reliable with identifying autism spectrum disorder (ASD) as young as age two (Mandell, et al., 2005). Community providers are recognizing symptoms earlier, resulting in earlier referrals to specialists (Charman et al., 2002), and use of the *Autism Diagnostic Observation Schedule* (ADOS) enhances diagnostic validity (Gotham, et al., 2009). The impact of clinician's *certainty* in determining ASD diagnoses in toddlers, however, is less clear.
Objectives:
This study examines certainty ratings made by experienced, licensed and research-reliable psychologists when determining diagnoses of 24-month-old toddlers participating in autism research studies that involved diagnostic outcome evaluations.
Methods:
Toddlers participated in studies at the Marcus Autism Center. The clinically-referred sample was collected through a study on early detection consisting of 181 toddlers: Mean age=24.1m; 75% male; 134 with ASD; 47 with non-ASD developmental delays (DD). The infant sample was collected through a longitudinal prospective study on infants siblings of children at High Risk (HR) or Low Risk (LR) for ASD. This sample consisted of 107 toddlers at their 24-month diagnostic evaluation: Mean age=24.5m; 64% male; 11 with ASD; 13 with broader phenotype (BAP); 7 with DD; and 75 with typical outcome (TD). Measures included *Mullen Scales of Early Learning (Mullen); ADOS-2; Communication and Symbolic Language Scales (CSBS), and Vineland Adaptive Behavior Scales, 2nd Edition* (*Vineland-II*).
Results:
Clinically-Referred Sample: Independent *T*-Tests revealed a significant difference in clinician certainty ratings (CR) between toddlers diagnosed with ASD vs. DD (Mean CR = 86.8% vs. 77.2%, respectively; $t(1,179)=-3.13$, $p<.01$). A trend for negative correlations were found between CR and *ADOS-2* social affect (-2.7; $p=.07$) and RRBs (-.26; $p=.09$) scores for the DD toddlers. *However*, strong positive correlations were found between CR and *ADOS-2* SA and RRB scores (.49 and .33, respectively; $p<.001$).
Infant Longitudinal Sample: ANOVA results revealed significant differences in CR percentages for diagnoses in the infant sample ($F(3,105)=10.1$; $p<.001$). Clinicians were most confident in determining TD outcome (CR mean=88.13%) compared to ASD (79.1%), DD (77.1%), and BAP (71.5%). Clinicians were also more confident in diagnoses merely based on risk status (LR mean=86.4%; HR mean=80.8%; $t(1,106)=2.22$; $p<.05$). In contrast to the clinically-referred toddlers, no significant correlations were found between CR and *ADOS-2* scores for the DD-outcome infants; however, strong negative correlations were found in the TD infants ($r=-.46$ for ADOS-2 SA and -.53 for RRB, $p<.001$). In the ASD-outcome infants, a positive correlation was found between *ADOS-2* SA and CR ($r=.76$; $p<.01$).
Gender, race, and maternal education levels had no impact on CR for either sample.
Conclusions:
Findings highlight that, for both samples, clinicians are more confident in diagnosing ASD versus non-ASD developmental delays. For HR toddlers, clinicians are less confident in diagnosing BAP. When blind to risk status, clinicians are less confident when determining diagnosis in HR toddlers. Increased symptomatology enhances certainty for ASD toddlers, whereas the opposite is true for TD toddlers. These results underscore the importance of clinician training in accurate and reliable assessment of ASD, particularly for young children and those who are at high-risk for ASD.

110 **142.110** How Reliable Is the Autism-Spectrum Quotient at Identifying Low and High Autistic Traits in College Students?

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Background: The Autism-Spectrum Quotient, a measure of autistic traits, is commonly used to identify neurotypical adults (often college students) with low and high levels of autistic traits for comparison. However, researchers disagree on whether the Autism-Spectrum Quotient should be scored by converting items to a binary scale or maintaining the 4-point Likert scale. Furthermore, researchers use different methods to categorize adults as having low or high autistic traits which range from inclusive (e.g., median split) to restrictive (e.g., upper/lower deciles). Additionally, restrictive identification methods often require a time delay between administration of the Autism-Spectrum Quotient and the task(s) of interest. Research is needed to assess the reliability of the Likert scoring method and identification of low/high autistic traits in neurotypical adults.
Objectives: The present study systematically investigated the reliability of the Autism-Spectrum Quotient for identifying autistic traits in college students. In particular, this study aimed to elucidate whether reliability varies by scoring method (binary or Likert) or categorization method (median split, upper/lower tertiles, quartiles, or deciles).
Methods: Four hundred three college students completed a computerized version of the Autism-Spectrum Quotient while their eye movements were recorded. A subset of students (n = 178) completed a second version at least one week later (M = 15.17 days, SD= 5.53).
Results: Internal consistency of the total scores was acceptable ($\alpha \geq .70$) for both scoring methods. Internal consistency for subscales varied ranging from acceptable (social skills for Likert scoring) to poor ($\alpha \leq .50$; imagination for both methods). Internal consistency improved with Likert scoring for the total and all subscales scores except for attention switching (all others $\chi^2(1) \geq 6.74$, $p \leq .009$). Test-retest reliability was strong ($r \geq .80$) for total scores for both methods, and all subscales for Likert scoring with the exception of imagination. Furthermore, test-retest reliability improved when using Likert scoring for total, social skills, attention switching, and attention to detail scores ($zs \geq -2.02$, $ps \leq .04$). Similar patterns of internal consistency and test-retest reliability were seen for men and women; however, men's total scores decreased over time using binary scoring ($t(54) = 2.44$, $p = .02$), whereas women's total scores increased over time using Likert scoring ($t(120) = -3.45$, $p= .001$). Categorizing individuals as low and high autistic traits was consistent across scoring method when using more inclusive methods (e.g., median split: 90.57%); however, agreement was reduced with more restrictive methods (e.g., deciles: 75.26%). Across time, the Likert method was equivalent or more stable than the binary method at categorizing individuals (e.g., median split: 85.80% versus 76.14%).
Conclusions: Overall, the Autism-Spectrum Quotient reliably assesses students' autistic traits. The Likert method is superior in internal consistency and test-retest reliability. Furthermore, the Likert method may have better consistency at categorizing adults as low or high in autistic traits. Therefore, it is recommended that researchers move to using Likert scoring. However, researchers should be cautious about using restrictive identification methods because categorization at extremes may change over time.

111 **142.111** Implications of Using the Social Responsiveness Scale in First-Time Diagnostic Assessment

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Background: The Social Responsiveness Scale (SRS) is a 65-item, Likert scale assessment designed to measure ASD-specific symptoms. While this scale is commonly used in diagnostic assessment, several studies have shown that the SRS may be correlated with traits other than ASD. For example, some studies have indicated that the SRS may be associated with general behavioral problems, cognitive functioning level, sex, and age.
Objectives: The purpose of this study was to determine whether there was an association between SRS scores and ASD diagnosis in a clinical pediatric population, when controlling for potential cofounding variables, including non-ASD behavioral problems and cognitive impairment.
Methods: This study included patients (ages 2-17) who presented for first-time diagnostic assessment. As part of their diagnostic assessment, parents of children completed the SRS in addition to other non-ASD clinical measures (e.g., CBCL). All children in our sample were diagnosed with one or more developmental disorders at the conclusion of their visit by a neurodevelopmental pediatrician or pediatric psychologist. Analysis of SRS total T-scores was conducted on the full population of patients for which SRS results were available. Subsequently, a regression analysis was performed on a subset of this population, in order to assess the degree of association between SRS total T-scores and ASD diagnosis, when controlling for behavioral and demographic factors. The variables controlled for in this analysis included age, sex, cognitive level (IQ), and behavioral problems (measured by the Child Behavior Checklist Externalizing Behavior section, or CBCL-E).
Results: Within the full group with SRS results available (n = 289), mean SRS scores were higher for participants diagnosed with ASD (t = 3.242, p = .001). However, both the mean T-scores of the group diagnosed with ASD and the group diagnosed only with non-ASD developmental disorders fell within the range of “moderate impairment”. When a regression model was fit to the subset of participants with IQ and CBCL-E scores available (n = 61), only behavioral problems (CBCL-E T-score) had a statistically significant relationship with the SRS total T-score (coefficient = .776, p < .001). ASD diagnosis had a small positive association with SRS score (coefficient = 3.580), but was not statistically significant. Subsequent analysis of the correlation between the SRS and CBCL-E found that the CBCL-E explained about 43% of the variance in the SRS scores.
Conclusions: The results of this study indicate that SRS scores are highly correlated with non-ASD behavioral problems, as measured by the CBCL-E, in a clinical pediatric population. In addition, while SRS scores were higher for participants diagnosed with ASD, both the ASD and non-ASD groups had scores that were elevated to clinically significant levels. Overall, this study supports the interpretation of the SRS in the context of a broader behavioral phenotype at first-time diagnostic visits.

112 **142.112** Initial Observations of Girls’ Social Presentation in a Clinical Setting

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Background:
Autism spectrum disorder (ASD) is estimated to be almost 5 times more common in boys than girls (Baio, 2014).What we know about profiles of ASD in girls lags behind what is known about boys, but research has shown inconsistencies in profiles of girls and boys. Greater cognitive impairment in girls (Frazier et al, 2014) and later age of diagnosis has been found, which can delay the start of intervention (Kavanagh et al., 2013; Rynkiewicz et al., 2012), while others have shown comparable developmental profiles between girls and boys (Zwaigenbaum et al., 2012). Clinicians in our diagnostic clinic often report different social presentations in girls that make diagnosis and case conceptualization difficult. In particular, clinicians note that many girls seem to initially present with strengths in eye contact, directed affect and play skills though weaknesses in these areas become more apparent over the course of the evaluation.
Objectives:
The purpose of this study is to analyze initial behavioral observations of girls who went on to receive ASD diagnoses in a clinical setting.
Methods:
A detailed record review was conducted of diagnostic evaluations for children ages 0-48 months between 1/1/2016 and 10/12/2016 in an autism center serving a diverse population. Children who were clinically referred received an initial diagnostic interview (DI) with a psychologist, neurologist or nurse practitioner. Those who were determined to have red flags for autism were referred on to receive diagnostic evaluations. Assessments each included a developmental/cognitive measure, adaptive measure and the ADOS-2.
Results:
84 girls (24% of total referrals) ages16-47 months were referred for a diagnostic assessment for ASD. Each patient received a diagnostic interview, after which autism was ruled out for 28% of the girls (compared to 15% for boys). The remaining 61 girls returned to assess for ASD, and of these 47 (78%) received an ASD diagnosis (compared to 88% for boys). Record review for those 47 girls, from initial behavioral observations during the diagnostic interview, revealed the following:Â 14 (30%) girls were noted to have “good” or “excellent” eye contact and an additional 14 (30%) were noted to have “inconsistent eye contact” or “moments of good eye contact.” In addition, thirteen (28%) girls were noted to have appropriate directed/shared affect and 7 (15%) girls were noted to engage in appropriate pretend play.
Conclusions:
These findings highlight the importance of comprehensive evaluations to assess for ASD in girls, especially given that initial clinical impressions noted strengths in key symptom areas (e.g., eye contact and directed facial expressions) in 30% of girls who went on to meet full behavioral criteria for ASD. Furthermore, these findings point to potential reasons for low referral rates of girls to autism specialty clinics; many providers may not recognize social vulnerabilities when initial impressions are that of good eye contact and directed affect. This underscores the importance of continued focus on symptom profiles of girls with ASD and translation of these findings to current clinical practices in screening and diagnosis of ASD in girls.

113 **142.113** Investigating the Causes of Informant Discrepancies in the Assessment of Autism Spectrum Conditions

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Background: Â
“Informant discrepancies are ubiquitous in research on the assessment, development and treatment of psychopathology” (De Los Reyes, 2011) and pose a major challenge to the diagnostic process of neurodevelopmental conditions such as autism. The current ‘gold standard’ for diagnosing autism includes an observational assessment (ADOS) and a caregiver interview (ADI), but little is known about the causes of discrepancies between these.
Past research has shown that parent report of child behaviour is influenced by factors including parental mental health (Treutler, 2003), parental gender (Hay, 1999), the age of the child (Bitsika, 2016) and parental income (Johnston, 2010).
Objectives: Â
We were interested in investigating whether there are systematic differences in evaluations of children with autism and whether specific contributions to these discrepancies can be identified.
Methods:
The sample consisted of 364 children (who took part in a randomised controlled trial of music therapy) between the ages of 4 and 8. The baseline assessment included the ADOS, the ADI, the Social Responsiveness Scale (SRS) and a life satisfaction questionnaire (QoL) for the child and the family. All children were followed up with ADOS assessments after 2, 5 and 12 months and parents filled in the questionnaires and attended counselling sessions. The latter were evaluated by conducting sentiment analyses on the transcripts of the sessions.
Growth curve modelling was used to examine the longitudinal data: The final model was a parallel linear growth model for informant discrepancies (z-scores of the ADOS and SRS scores were used to derive a signed difference score across time) and QoL. The predictors tested included the age of the child, the linguistic ability of the child, parental education and the gender of the parent.
Results:
As data collection finishes in November 2016 only preliminary results are currently available.
However the findings replicate previous research indicating stronger correlations between the parent report measures (ADI and SRS) than between parent and clinician measures (ADI & ADOS and SRS & ADOS).
In addition both the quality of life ratings as well as obtained sentiment scores correlated negatively with autism severity reported in the SRS, whereas none of the measures correlated with the total ADOS scores.
Only language ability emerged as a significant predictor in the growth curve analysis.
Conclusions:
Two factors were identified which are associated with informant discrepancies: the language ability of the child and parental wellbeing.
Language delay is often the first concern noted by parents (De Giacomo & Fombonne, 1998) and thus could play a role in the perceived severity of the condition by parents whereas behavioural observations should be sensitive enough to assess other diagnostic domains which are sometimes missed by parents of young children (Chawarska et al. 2006).
Furthermore the impact of the family's quality of life on the cognitive appraisal of the child's condition underlines the need to investigate the importance of post-diagnostic support on parental wellbeing.

114 **142.114** Longitudinal Prediction of Adaptive Behavior from Sensory Features and Intensity of Services in Children with ASD and Other DD

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Background:
Many behavioral therapies target sensory features in autism spectrum disorder (ASD) and other developmental disabilities (DD) throughout childhood. Little is known about the association of these sensory features with adaptive functioning over time in ASD, how these adaptive outcomes may vary in association with various treatments, and if these associations differ by diagnosis.
Objectives:
Our aims were to (1) examine the longitudinal association between early sensory features [hyporesponsiveness (HYPO), hyperresponsiveness (HYPER), and sensory interests, repetitions, and seeking behaviors (SIRS)] and adaptive functioning outcomes (daily living, socialization, communication, and an overall composite score); and (2) determine if these associations are moderated by services received or diagnostic category.
Methods:
50 children with ASD [Time 1: 5.5(2.3) years] and 31 children with DD [Time 1: 5.7(2.6) years] participated across two time points approximately 3.6(1.5) years apart. Sensory measures at Time 1 included two parent-report measures: the Sensory Experiences Questionnaire Version 3.0 and the Sensory Profile; and two observational assessments: the Sensory Processing Assessment and the Tactile Defensiveness and Discrimination Test-Revised. Adaptive outcomes at Time 2 were measured using the Vineland Adaptive Behavior Scales-Survey Edition. We also collected data on amounts of therapy (occupational, speech-language, and physical) and special education services received between timepoints. Data were analyzed using a series of step-down regression models, with diagnostic group and services included as potential moderators. Covariates included child gender, age at baseline, IQ, household income, mother’s education, and time between data collection points.
Results:
Greater parent-reported HYPO behaviors were associated with lower Daily Living scores after controlling for therapy ($F(1, 59) = 4.17$; $p = 0.05$) and special education services ($F(1, 59) = 4.52$; $p = 0.04$), with a steeper decline for DD than ASD. The same trend was significant for ABC scores ($F(1, 73) = 4.16$; $p = 0.05$) and Socialization ($F(1, 73) = 3.89$; $p = 0.05$) when controlling for special education services but not significant when controlling for therapy services.
Greater parent-reported HYPER scores predicted poorer ABC ($F(1, 76) = 5.65$; $p =0.02$) and Daily Living outcomes ($F(1, 62) = 14.02$; $p < 0.001$) across groups and services amount. Three-way interactions between HYPER, group, and educational treatment ($F(1, 70) = 6.20$; $p = 0.02$) and Communication ($F(1, 70) = 4.60$; $p =0.04$) were also significant for ABC.
Higher parent-reported SIRS behaviors were associated with better adaptive outcomes for the DD group, and poorer adaptive outcomes for the ASD group on all outcomes of the VABS after controlling for both service types. These trends were in the opposite direction in observer-measured SIRS. As scores increased, ABC outcomes increased for the ASD group and decreased for the DD group ($F(1, 73) = 4.74$; $p = 0.03$).
Conclusions:
Sensory features and therapy services were associated differentially with later adaptive outcomes, sometimes influenced by type of sensory measure (parent-report or observed) or diagnostic group. Interestingly, services were associated with poorer adaptive outcomes, possibly because children with more severe ASD receive more services regardless of effectiveness. Future treatment studies using RCTs are needed to address this question.

115 **142.115** M-CHAT-R/F - Translation & Validation in Hindi

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Background: Internationally, many validated tools are available for screening, diagnosing, and characterizing individuals on the autism spectrum. However, use of these measures is limited in non-English speaking countries, such as South Asia. India is a country of many languages, and based on the Indian Census data, Hindi is the primary language of over 41% of the Indian population. Translation into regional languages and validation is the first step towards establishing clinical and research standards in India and other South Asian countries. The Modified Checklist for Autism in Toddlers – Revised with Follow up (M-CHAT-R/F) is a freely available tool that is used widely to screen for autism spectrum conditions and other developmental delays in toddlers within the age group of 16 – 30 months. In a low resource country like India, having a freely accessible autism screening tool in the local language is crucial to identify young children on the spectrum and ultimately impact the access to intervention and prognosis of children with autism.
Objectives: To translate the M-CHAT-R/F to Hindi and to validate the translated version of M-CHAT-R.
Methods: The translation process involved the 4 step procedure namely – translation of the English M-CHAT-R/F into Hindi by two independent teams fluent in both the languages, compilation in to one document by a third team, blind back-translations and finally getting the translation edited and reviewed. The blind back translations were done by independent language experts, and were then evaluated by bilingual members of the research team. This cycle was repeated until the blind back translations were close to the original tool. In order to validate the translated Hindi version of the tool, it was administered with parents of 53 toddlers from New Delhi. Of the 53 toddlers, 32 children showed typical development and 21 toddlers had a diagnosis of autism spectrum disorder.
Results: An independent samples t-test showed significantly different mean scores (t =24.1, df = 7.77, P = 0.00) for autism (M = 8.61, SD = 4.21) and the typically developing group (M = 1.12, SD = 1.57). 20 out of the 21 children with autism screened positive on M-CHAT-R. Of the typically developing sample, 91% screened at low risk, 6% were found to be at medium risk and the remaining sample of 3% screened at high risk. The follow up indicated a negative screening for all typically developing toddlers who screened at medium or high risk on M-CHAT-R.
Conclusions: This holds direct implications for improving diagnosis of autism, by clinicians within the Hindi speaking population in India and other South Asian countries.

116 **142.116** Measurement Properties of Tools Used to Assess Suicidality in Adults with and without Autism Spectrum Conditions: A Systematic Review

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Background: Recent research has shown significantly increased rates of suicidal thoughts, behaviours and death by suicide among adults with Autism Spectrum Conditions (ASC), and hence a need to effectively assess suicidality in research and clinical practise. However, it is unclear what tools if any are currently available to assess suicidality in people with ASC, or whether tools used in the general population need to be adapted for this group.
Objectives: 1) To identify tools used to assess suicidality in adults with and without ASC; and 2) To evaluate these tools for their appropriateness and measurement properties.
Methods: Electronic databases including Medline, Psychinfo, Web of Knowledge, Cochrane database and registers were searched for studies of suicidality in a) adults with ASC, and without co-morbid learning disability; and b) adults from the general population, and without any co-morbid conditions. Articles examining the measurement properties of these identified tools were then searched for using a methodological filter in PubMed, and the quality of the evidence for each tool evaluated using the COSMIN checklist.
Results: No studies were identified which utilised a validated tool to assess suicidality in adults with ASC. Twenty-two articles were identified which have utilised 12 tools to assess suicidality in general population adults, 4 of which had been used frequently with evidence of validity. These 4 tools were evaluated for the quality of the evidence of their measurement properties.
Conclusions: Overall 3 tools were found which were robust in their measurement properties; the Beck Scale for Sucide Ideation, the Columbia Suicide Severity Rating Scale, and the Suicide Behaviour Questionnaire Revised. However, none of these scales have yet been used to assess suicidality amongst those with ASC. Future research needs to adapt and validate these tools for adults with ASC. This is key to ensure that suicide risk is properly assessed in this high risk group in future research and clinical practise.

117 **142.117** Parent Reported Development and Withdrawal Informs Differential Diagnosis of Autism Spectrum Disorder Versus Developmental Language Disorder in Children Under 6

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Background: Efforts to improve rates of identification of Autism Spectrum Disorder (ASD) at younger ages have largely focused on differentiating children with ASD from neurotypicals children. In clinical practice, among children under age 6 presenting with concern for ASD who are not ultimately diagnosed with ASD, one of the most common diagnoses is Developmental Language Disorder (DLD). Easily administered parent-report measures may be helpful in facilitating differential diagnosis of ASD versus DLD. However, no measures for this specific purpose are currently available, and it remains unknown whether existing measures may be helpful in this regard.
Objectives: The current study aimed to identify aspects of parent-rated development and emotional/behavioral symptoms that may facilitate differentiation of ASD (with or without comorbid DLD) from DLD (without ASD) among children under age 6 presenting with concern for ASD.
Methods: Medical record review was conducted for 90 children ages 19 months to 5 years, 5 months (M_{age} = 3 years, 4 months) who were evaluated within a multidisciplinary autism evaluation clinic within the University of Michigan Health System Department of Neurology. Of these, 54 children were diagnosed with ASD (with or without DLD) and 28 were diagnosed with DLD (without ASD). Record review included results of parent report questionnaires (Child Development Inventory [CDI], Child Behavior Checklist [CBCL], and Social Communication Questionnaire [SCQ]). Mann-Whitney *U* tests were conducted to examine group differences in CBCL and SCQ standardized scores. For CDI, difference scores were calculated by subtracting age equivalence scores from chronological age. Chi square tests were conducted to determine group differences in the probability of falling within the delayed range (Z score ≤ -1.5) on the CDI.
Results: Â As expected, SCQ scores were significantly higher for children with ASD than DLD (U = 389, p < .005). On the CDI, children with ASD had greater difference scores than DLD (U = 455, p < .05) and were more likely than DLD to be classified as delayed in general development (χ^2 = 7.8, p < .05). Specifically, children with ASD were more likely to be classified as impaired in the domains of social development (χ^2 = 7.05, p < .05) and language comprehension (χ^2 = 5.22, p < 0.05). Additionally, difference scores for children with ASD were significantly greater than DLD for both receptive (U = 438, p < .05) and expressive language (U = 455, p < .05). Children with ASD were also rated as significantly more withdrawn on the CBCL than DLD (U = 418, p < .05).
Conclusions: Â Parent ratings on the withdrawal subscale of the CBCL and social, receptive and expressive language subscales of the CDI may add useful information in the differential diagnosis of ASD versus DLD among children under age 6 presenting with concern for ASD. Development of a parent-report measure including items indexing social and language development as well as withdrawal may provide greater clinical utility in this regard.

118 **142.118** Parent and Teacher Report of Behavioral Symptoms in Autism Spectrum Disorders: Assessing the Impact of Demographic and Socioeconomic Factors

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Background:
Clinical evaluations of children with suspected neurodevelopmental disorders often requires observations of the child across settings, as well as, report of behavioral symptoms by multiple raters. This can be particularly informative as symptoms may be expressed differently across settings (Kanne, Abbacchi, & Constantino, 2009). However, reporting of behavior may be influenced by the reporter's own perception of the behavior and may be subject to potential biases. Thus, understanding the validity and reliability of behavioral reports within clinical and research settings is critically important.
Objectives:
The goal of this study it so assess the impact of demographic and socioeconomic factors in the reporting of behavioral symptoms by parents and teachers in a diverse sample of children with ASD.
Methods:
The current study is part of a larger study evaluating developmental profiles of diverse children with ASD who visited a developmental disabilities clinic located in an urban city in the United States. Clinic records of children between 3 and 12 years of age with clinical diagnoses or educational classifications of an Autism Spectrum Disorder were reviewed. Information about demographics (e.g., race, ethnicity, nativity), socioeconomic factors (private vs. public insurance) were collected from the clinic records. As the measure of children's behavioral symptoms, the Child Behavior Checklist (CBCL; Achenbach, 2000, 2001) and Teacher Report Form (TRF; Achenbach, 1997, 2001) administered in English or Spanish were scored as the dependent variable.
Results:
Preliminary analyses were conducted on the subset of children who were between 3 and 5 years of age (n = 21). Descriptions of the sample are included in Table 1. Paired-sample t-tests compared parent and teacher report of behavioral symptoms, specifically the t-scores for the DSM Oriented Scales of the CBCL and TRF. Paired-sample t-tests initially compared parent and teacher reports separately across race groups (White, African-American), finding significant discrepancies between parents and teachers report on anxiety, ADHD, and oppositional defiant behaviors for African-American children with ASD (all p's < .05). However, for White children with ASD, discrepancies between parent and teacher report of behavioral symptoms were only observed for ADHD symptoms (p< .001). Additional analyses will be presented at IMFAR that will include additional subscales from the CBCL and TRF and the entire sample of children with ASD (age 3 to 12 years).
Conclusions:
Although there is extensive research on the utility of the CBCL and TRF in the identification of children with ASD, there is limited research investigating the impact of demographic and socioeconomic factors on the validity and reliability of these tools in diverse populations. These preliminary analyses found that teachers in general reported greater ADHD behaviors than parents did for young children with ASD. However, teachers also reported greater difficulties with anxiety and oppositional defiant behaviors for African-American children with ASD. It may be that these challenges emerge to a greater extent in the school setting. Additional analyses will investigate whether the discrepancies between parent and teacher report of behavioral symptoms varies as a function of other demographic and socioeconomic factors.

119 **142.119** Parent-Reported Executive Functioning and Adaptive Social Skills in School-Age Children with ASD

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Background: Individuals with autism spectrum disorder (ASD) present with deficits in socialization and communication. Research has also documented impaired executive functioning (EF) in this population, yet few studies have looked at the expression of specific EF deficits in the everyday social skills of children with ASD.
Objectives: This study assessed the relationship between components of EF and adaptive social skills in school-age children with ASD.
Methods: Participants were 29 children (25 males; mean age 9.4 ± 1.6 years) drawn from a larger study on the early detection of ASD, in which they were diagnosed with either Autistic Disorder or Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS) at 2 and 4 years. Diagnosis was confirmed at school-age follow-up using the Autism Diagnostic Observation Schedule (ADOS), and IQ was assessed with the Differential Ability Scales, Second Edition (DAS-II) or Stanford-Binet Intelligence Scales, Fifth Edition (SB-5). EF and adaptive functioning were measured using parent reports: the Behavior Rating Inventory of Executive Function (BRIEF) and Vineland Adaptive Behavior Scales, Second Edition (VABS-II). Correlation and hierarchical regression, controlling for IQ, were used to examine the relationship between EF scales and adaptive social skills. Due to the small sample size and risk of Type I and Type II errors, a conservative cutoff of α = .01 was used for all analyses.
Results: VABS-II Socialization and Communication were negatively correlated with BRIEF Emotional Control, Inhibit (Socialization only), Monitor, Shift (Socialization only), and Working Memory (all Pearson's r's > .50, all p's < .01). Results of partial correlations controlling for IQ (i.e., DAS-II General Conceptual Ability or SB-5 Brief IQ) were consistent with Pearson's correlations, with one exception; the correlation between VABS-II Communication and BRIEF Monitor (r = -.405, p = .040) was no longer significant using our conservative cutoff. Hierarchical regressions were then run with IQ entered first, followed by each BRIEF scale entered individually in a second block. Results were consistent with partial correlation findings.
Conclusions: This study examined the relationship between parent-reported EF and adaptive social skills in school-age children with ASD. Results suggest that EF deficits are significantly related to the social and communication impairments seen in children with ASD. Specifically, BRIEF Emotional Control, Inhibit, and Shift, which assess ability to regulate behavior, exercise flexibility, and modulate emotional response, were significantly associated with VABS-II Socialization. BRIEF Monitor and Working Memory, which measure ability to assess one's own performance and hold information in mind to complete a task, were also significantly associated with level of social skills. Further, a strong relationship between VABS-II Communication and BRIEF Emotional Control and Working Memory was found, suggesting that children with greater emotion regulation and information processing capabilities demonstrate higher language skills. These findings held when overall cognitive level was controlled. It is possible that children with limited social interaction learn fewer EF skills through instruction or modeling, but it is equally or more probable that EF deficits lead to impaired social communication skills. Thus, children with ASD may benefit from targeted EF intervention to improve everyday social behaviors.

120 **142.120** Parent-Reported Features Associated with Clinical Ratings of Autism Severity in Preschool Children:

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Background: Early detection of autism spectrum disorder (ASD) symptoms facilitates early intervention associated with improved developmental outcomes. Developmental improvements gained in early intervention programs are most often seen in relation to co-occurring conditions, such as adaptive and cognitive delays, instead of the ASD diagnostic symptoms of social communication and interaction, and restricted interests and repetitive behaviors. More research is needed to identify parent-reported features of ASD associated with diagnostic symptom severity so those features can be evaluated in intervention programs.
Objectives: In order to highlight potentially modifiable child characteristics, this study aimed to identify parent-reported features associated with clinical ratings of ASD severity in preschool children.
Methods: Three groups of children 2-5 years old were ascertained for the Study to Explore Early Development (SEED): (1) those with known ASD, (2) those with another developmental delay or disorder, and (3) those identified through birth certificate records. All children were screened for ASD with the Social Communication Questionnaire upon enrollment. Children who screened positive for ASD or had a previous ASD diagnosis were asked to complete an in-person assessment that consisted of the Autism Diagnostic Observation Schedule (ADOS) and Mullen Scales of Early Learning (MSEL). Caregivers completed the Autism Diagnostic Interview – Revised (ADI-R) and an interview that gathered sociodemographic information. Children classified as ASD met ADOS criteria *and* either standard ADI-R criteria or one of three alternate ADI-R criteria (alternate ADI-R criteria are described elsewhere; Wiggins et al., 2015).
The association between domain scores from the ADI-R and ASD severity from the ADOS was assessed using regression analysis. Independent and dependent variables were assessed for multicollinearity. The following covariates were entered into the model: child age, child ethnicity, child race, child sex, household income, maternal age, maternal education, and MSEL expressive language, receptive language, fine motor, and visual reception scores. ADI-R domain scores associated with ASD severity were further evaluated to detect individual diagnostic items within those domains associated with ASD severity.
Results: 707 children met the SEED ASD case definition. Higher household income was associated with higher ASD severity, and more advanced expressive language skills was associated with lower ASD severity. Higher ADI-R behavioral and social domain scores were associated with higher ASD severity, when controlling for household income and expressive language ability. Within the ADI-R behavioral domain, more hand and finger mannerisms, repetitive use of objects, and unusual sensory response were each associated with higher ASD severity scores; more compulsions/rituals were associated with lower ASD severity scores. Within the ADI-R social domain, deficits in eye gaze, response to the approach of other children, and sharing enjoyment were each associated with higher ASD severity scores; less interest in other children was associated with lower ASD severity scores.
Conclusions: Our results highlight specific parent-reported ASD symptoms that are associated with clinical perception of diagnostic presentation and can be evaluated in intervention programs and research protocols. These results also highlight the need for multi-domain treatments that address the many needs of children with ASD and their families. Implications for intervention will be discussed.

121 **142.121** Predictive Validity of the MCHAT-R in a Clinical Sample

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Background:
Extant literature upholds the importance of early, intensive intervention in maximizing positive outcomes for children with autism spectrum disorder (ASD; Sullivan, Stone, and Dawson, 2014; Warren et al., 2011). Research suggests that the most efficacious interventions for children with ASD start as early as risk is identified and persist during early childhood (Wallace & Rogers, 2010). Individuals with risk markers for ASD must be identified as soon as possible to initiate services. The Modified Checklist for Autism in Toddlers, Revised with Follow-Up (MCHAT-R/F) has demonstrated reliability and validity, as well as improved utility over the original MCHAT, in detecting ASD in low-risk toddlers (Robins, et al., 2014). MCHAT-R/F was designed to facilitate reduced age of diagnosis and commencement of early intervention.
Objectives:
The current research examines diagnostic agreement between the MCHAT-R and clinical diagnosis in clinical sample to further investigate validity of this instrument.
Methods:
Data was collected from young children (n=201; 33 = female, 168 male; and mean age= 28.69 months) who visited a hospital-based early diagnostic screening clinic regarding autism spectrum disorder-related concerns (9/1/2015- 9/1/2016). These patients participated in a full battery of testing, including diagnostic interview, MCHAT-R/F, ADOS-2, Mullen, and Vineland-II. The battery did not incorporate the MCHAT-R/F follow-up questions as clinicians conducted thorough clinical interviews with caregiver(s). All clinicians (n=6) were licensed clinical psychologists who have demonstrated research reliability regarding the ADOS-2.
Diagnostic outcomes included 133 diagnoses of autism spectrum disorder (ASD) and 68 diagnoses of No ASD. In order to examine diagnostic agreement, we calculated the M-CHAT-R sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) compared to clinical diagnostic decision. A 2x2 table was constructed based on the presence and absence of ASD as well as low risk (≤2) and medium-to-high risk scores (≥3) on the MCHAT-R.
Results:
With the current sample, MCHAT-R sensitivity was 86.46%, specificity was 32.35%, PPV was 70.7%, and NPV was 50%. Therefore, the probability of the MCHAT-R correctly identifying individuals *with ASD* was 86.56% and correctly identifying individuals with *No ASD* is 32.35%. With this sample, the probability of *ASD* with a positive MCHAT-R screen is 70.70% and the probability of *no ASD*with a negative MCHAT-R screen is 50%.
Conclusions:
Based on the current clinical sample of young children with red flags for ASD, the MCHAT-R demonstrates greater sensitivity than specificity and greater PPV rather than NPV. This suggests that the MCHAT-R often captures individuals with developmental concerns, including ASD; however, it indicates that a low risk score on the MCHAT-R may not be sufficient to rule-out an ASD diagnosis. Results from our sample suggest that the M-CHAT-R continues to be helpful in identifying broader developmental concerns in addition to ASD-related vulnerabilities. These results also highlight the importance of post-screening evaluation for differential diagnosis, particularly with complex presentations of developmental concerns. The present data supports further investigation regarding what factors might influence MCHAT-R scores/reporting to inform clinical practice.

122 **142.122** Profiling Autism Symptomatology in Females: An Exploration of the Q-ASC in a Clinical Setting

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Background: Highlighted differences in the clinical research literature among children and adolescents with Autism Spectrum Disorder (ASD) reflect a unique presentation of ASD among females, demonstrated by greater compensatory capacity and ability in social masking, camouflaging and imitation. It is argued that such presentation may have an inhibitory potential in confirming a diagnosis using current diagnostic assessments and screening tools. Recent clinical experience, parental reports and autobiographies indicate psychological tension, distress and exhaustion for females with ASD in their attempts to compensate for difficulties in understanding and interacting with others. The emerging evidence of a presentation in females, distinct from the current and widely accepted features of ASD, based primarily on males, means current diagnostic assessments lack the required sensitivity to identify females with ASD. To address this gap, the Questionnaire for Autism Spectrum Conditions (Q-ASC) was developed by Attwood, Garnett and Rynkiewicz (2011) to identify gender-sensitive profiles of ASD symptomatology; prioritise and adjust the direction of clinical interventions; and support positive psychosocial outcomes and prognosis into adulthood.
Objectives: This study aims to provide an exploratory and preliminary statistical investigation of the interpretable and reliable constructs of the Q-ASC, and examine differences in presentation across male and female children and adolescents with ASD.
Methods: Drawing on archival data, the current research piloted the Q-ASC within a clinical population of 232 children and adolescents. Parent-completed Q-ASC data comprised clinical diagnoses of Autism Spectrum Disorder (ASD) – level 1 (without intellectual or language impairment). In addition, sociodemographic information included participants' age, and gender identification, and clinical information of diagnostic status. The sample included 134 males and 100 females with ages ranging between 5 -19 years (*M* = 12.18, *SD* = 3.8).
Results: Data analysis revealed eight interpretable and reliable components of the Q-ASC using Principle Components Analysis (PCA); *gender identity*, *sensory sensitivity*, *compliant behaviour*, *friendships and play, social masking*, *imagination*, *imitation*, and, *talents and interests*. Analysis of Variance (ANOVA) was used to examine mean differences between gender and age groups. Results found a statistically significant difference of parent-reported features among males and females, with greater levels of reported difficulty for females in behavioural characteristics related to the domains of *Gender Identity*, *Sensory Sensitivity*, *Social Masking*, *Imagination*, *Imitation*, and *Talents*.
Conclusions: This study represents an exploratory and systematic review of potential female presentations in children and adolescents across a clinical setting, with meaningful differences noted. The results of this study support previous autobiographical, anecdotal and clinical observations to suggest important practical and clinical significance in understanding the difference in ASD characteristics between males and females. The eight interpretable and reliable constructs reported moderate to high internal consistency, with greater levels of parent-reported socio-behavioural characteristics for females, compared to males, with ASD. The findings from this study aim to identify improvements in the validity and robustness of Q-ASC to assess the sensitivity and diversity of ASD presentations among female children and adolescents.

123 **142.123** Race Influences Parent Report of Concerns about Symptoms of Autism Spectrum Disorder

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Background: Despite progress in the early identification of autism spectrum disorder (ASD), Black children are diagnosed later than their White peers (Mandell et al., 2007, 2009). Mandell and colleagues (2007) found that Black children were often misdiagnosed with conduct and oppositional defiant disorders prior to an ASD diagnosis. The researchers posited that Black parents may relate concerns about their children's development to healthcare providers in ways that de-emphasize ASD-specific symptoms and emphasize disruptive behaviors, which may impact clinicians' consideration of ASD.
Objectives: We tested the hypothesis that compared to White parents, Black parents of children with ASD would report fewer concerns about their children's behaviors specific to ASD, and would be more likely to report concerns about children's disruptive behaviors.
Methods: A sample of parents (N=207; 135 White, 72 Black parents) and their 18-40 month old toddlers (mean age=25.84 m, *SD*=4.74) with ASD participated. After screening positive for ASD risk, but prior to the diagnostic evaluation, parents completed free-response questions soliciting concerns about their children's development. Parent responses were coded for the presence or absence of 10 domains of concerns, which were grouped into ASD-specific concerns (i.e., speech/communication, restricted and repetitive behaviors (RRB), social deficits, and directly naming autism/ASD as a concern) or non ASD-specific concerns (e.g., general developmental concerns, disruptive behavior concerns), adapted from Ozonoff and colleagues (2009) by Richards and colleagues (2016). ASD symptom severity, measured by the domain and total severity scores from the Autism Diagnostic Observation Schedule (ADOS-2; Gotham et al., 2009; Hus et al., 2014), were used as covariates to control for the possibility that racial differences in ASD-specific concerns are due to group differences in symptom severity in our sample.
Results: White parents (*M*=2.47, *SD*=1.31) endorsed a greater number of categories of concerns (i.e., the sum of all 10 concern categories) than Black parents (*M*=1.85, *SD*=.94), $t(187.01)=3.91$, $p<.001$, partial $\eta^2=.08$. There was a significant effect of race on ASD-specific concerns $F(1,167)=10.04$, $p<.001$, partial $\eta^2=.06$. Black parents reported significantly fewer ASD-specific concerns than White parents ($M_{diff}=.42$, $SE=.13$, $p<.001$). In particular, Black parents were less likely than White parents to report concerns about social deficits, $\chi^2(3)=8.217$, $p=.04$ and RRB, $\chi^2(4)=18.97$, $p<.001$, even after controlling for ASD symptom severity. There was not a significant effect of race on non ASD-specific concerns ($p=.28$) or disruptive behavior concerns specifically ($p=.17$).
Conclusions: Reporting fewer ASD-specific concerns by Black parents may impact providers' abilities to identify children in need of evaluations. There was not a racial difference in parent report of concerns about children's disruptive behaviors, suggesting that underreporting of ASD-specific concerns is not likely explained by parent interpretation of ASD symptoms as disruptive behaviors. Future studies should examine factors that may explain report of fewer ASD-specific concerns by Black parents of children with ASD, such as less knowledge about ASD and cultural differences in expectations or interpretations of children's behaviors or willingness to report concerns specific to ASD. Future research should also examine other factors, such as clinician biases, that may contribute to delayed diagnosis for Black children with ASD.

124 **142.124** Relationship Between Cognitive Abilities and ASD Severity over Time in Early-Diagnosed Preschoolers

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Background: According to the most recent prevalence study conducted by the Centers for Disease Control, 38% of children with ASD have a co-occurring Intellectual Disability (CDC, 2008). Previous studies have found that children with average cognition or mild-moderate cognitive delays at the time of initial ASD diagnosis demonstrate increased cognitive scores at follow-up, whereas children with severe cognitive delays at initial diagnosis show stable scores over time (Flanagan et al., 2015). Limited research has been conducted examining the relationship between cognitive functioning and expression of ASD symptoms. Matson et al. (2008) found that IQ predicted the presence of ASD-like behaviors in adults without ASD, but IQ was not related to the expression of ASD symptoms in adults with the disorder. In contrast, developmental level was associated significantly with symptom severity, similarly, in toddlers with Autistic Disorder, PDD-NOS, and no ASD (Matson et al., 2012). However, Goldin et al. (2014) found that higher ASD severity scores were associated with lower developmental abilities in toddlers.
Objectives: The goals of this study were to 1) examine the stability and mean level change of cognitive abilities in children with ASD, and 2) determine the relationship between ASD symptom severity at initial diagnosis and later cognitive ability, in a sample of early-diagnosed children.
Methods: 35 children (86% male) were evaluated at two time points (T1 mean age=27.9 months; T2 mean age=52.3 months) using the ADOS-2, expert clinical judgment, and measures of cognitive functioning (T1: Mullen Scales of Early Learning; T2: Differential Abilities Scales-II). All children met diagnostic criteria at Time 1, whereas 30 children (85.7%) met criteria at Time 2. The sample was racially and ethnically diverse (57.1% White, 17.1% Black/African American, 8.6% Asian, 2.9% Arab, 8.6% multiracial; 17% Hispanic/Latino). ASD symptom severity was determined by total ADOS-2 algorithm score (T1) and ADOS-2 comparison score (T2).
Results: Children demonstrated significantly improved IQ scores between Time 1 (M=65.9, SD=13.7) and Time 2 (M=82.7, SD=35.1) ($t(32)=-2.96$, $p<.01$). A multiple linear regression model was calculated to predict overall IQ score at Time 2, based on overall IQ score and ASD symptom severity at Time 1. A significant regression equation was found ($F(2,28)=11.65$, $p<.01$) with $R^2=.45$. Both overall IQ score and ASD symptom severity at Time 1 were significant predictors of overall IQ score at Time 2.
Conclusions: Children diagnosed with ASD at age 2 demonstrated significantly improved IQ scores at age 4, suggesting that early cognitive abilities may not be stable in children with ASD; once ASD symptoms are directly targeted in treatment, children may demonstrate increased capacity for learning. In addition, both overall IQ score and ASD symptom severity at age 2 uniquely predicted overall IQ score at age 4. This finding has implications for treatment planning for children diagnosed with ASD before 36 months, as all children in this sample received early intervention services prior to and between initial diagnosis and follow-up.

125 **142.125** Role of the AOSI in Predicting Autism Spectrum Disorder in Tuberous Sclerosis Complex

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Background: Historically, autism spectrum disorder (ASD) has been reported in approximately 50% of individuals with Tuberous Sclerosis Complex (TSC). The severity and underlying causes of ASD are complex and highly variable, which presents a major barrier to identifying at-risk infants.
Objectives: Evaluate the ability of the Autism Observation Scale for Infants (AOSI) to identify at-risk infants with TSC who will later get diagnosed with ASD.
Methods: Analysis was performed on 130 patients ages 0-36 months with TSC participating in the TSC Autism Center of Excellence Network, a large multicenter, prospective observational study evaluating biomarkers predictive of ASD. Patients were evaluated longitudinally at ages 3, 6, 9, 12, 18, 24 and 36 months with standardized evaluations using cognitive, adaptive, and behavioral measures, as well as autism-specific testing at specific time points. At 12 months, the AOSI was administered to look for specific behavioral risk markers for ASD. The Autism Diagnostic Observation Schedule-Second Edition (ADOS-2) and Autism Diagnostic Interview-Revised (ADI-R) were administered at 24 and 36 months at which point a diagnosis of ASD or not ASD was assigned based on a combination of above stated measures, clinical impression, and consideration of comorbid diagnoses.
Results: At 24 months, 14 patients out of 65 were given a clinical diagnosis of ASD (21.5%). At 36 months, 4 patients out of 21 were given a clinical diagnosis of ASD (19%). The Mean AOSI total score in patients diagnosed with ASD at 24 months was 13.5 (SD 6.7) versus mean AOSI total score of 7 (SD 5.3) in patients not diagnosed with ASD ($p=0.003$). The odds ratio for the AOSI predicting ASD at 24 months was 1.19 ($p=0.003$ [CI 1.06-1.33]). In other words, for every 1 point increase in total score on the AOSI, the odds of going from non-ASD to ASD increases by 19%. The AOSI total score also significantly predicted meeting cut-off scores on the individual domains on the ADI-R in patients diagnosed with ASD at 24 months ($p<0.05$). There were also several individual items on the AOSI that were found to significantly predict ASD diagnosis at both 24 and 36 months. Additionally, diagnosis of ASD based on ADOS-2 classification alone was compared to clinical diagnosis. At 24 months the ADOS and clinical diagnosis agreed on all non-ASD diagnoses. In patients who were diagnosed with ASD, the ADOS-2 classification and clinical diagnosis agreed 46% of the time (17 out of 37 patients). However, 54% of patients (20 out of 37) met ASD classification on the ADOS-2 but did not receive a clinical diagnosis ($p<0.0001$). The study is ongoing and many patients have not completed 36-month assessments. This may help to explain the lack of significance for this age group.
Conclusions: The AOSI performed at 12 months predicts later diagnosis of ASD in patients with TSC at 24 months. Clinical diagnosis of ASD in individuals with TSC differs from classification based on the ADOS-2. This difference is likely due to other medical comorbidities seen in TSC. Further analysis will help to clarify these discrepancies.

126 **142.126** STAT Behavioral Domains As Predictors of ASD Severity and Cognitive Outcomes

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Background: The Screening Tool for Autism in Toddlers (STAT) is a brief, interactive, validated screening assessment for autism comprised of 12 activity-based items that provide 4 behavioral domain scores—play, imitation, requesting, and directing attention—as well as a total score indicating autism risk. The item-domain structure of the STAT has never been validated via confirmatory factor analysis (CFA). The STAT domains represent discrete, developmentally appropriate social-cognitive skills, and each domain may differentially predict both children's overall autism severity and cognitive ability at 2-3 years. Each domain of the STAT has been found to augment the STAT's overall high predictive validity with autism diagnosis. However, it is not known how differentially predictive the STAT domains are of autism symptomatology and cognitive ability in a large sample of children recruited from the general population with elevated autism concern.
Objectives: Â To (1) perform a CFA to confirm that items of the STAT theoretically proposed to form domains do indeed form the 4 STAT domains, and (2) perform a latent path model to assess the predictive validity of the STAT domains to gold-standard autism diagnostic instruments, the ADOS and Mullen.
Methods: Participants (*n*=380) were 24-39 months of age and recruited from eight sites funded as part of a National Children's Study formative research project. 79% of participants had prior autism concerns; 21% had concerns about developmental delay. Participants received diagnostic evaluations from a qualified clinician, including the ADOS and Mullen, in the community or as part of the study. The STAT was administered as part of a larger battery of autism screening tools. A CFA was conducted to assess how well the items comprising the 4 domains of the STAT—play, imitation, requesting, and directing attention—mapped on to each domain. A latent path model assessed how participants' latent STAT domain scores related to their ADOS severity score and verbal and nonverbal Mullen scores. State-of-the-art model-fitting procedures were employed for evaluation.
Results: The theorized 4 latent factors for the play, requesting, directing attention, and imitation STAT domains fit the data well (e.g., CFI=.98; RMSEA=.03), supporting the item allocation into each domain as originally designed. The 4 resulting latent STAT domains were highly correlated. The final latent path model fit the data well (e.g., CFI=.97; RMSEA=.03). Three of the 4 STAT domain scores (imitation, requesting, and directing attention) were found to significantly predict ADOS severity. STAT play and imitation domains were found to significantly predict Mullen nonverbal subscale score. The STAT directing attention domain was found to be the best predictor of Mullen verbal subscale score (Figure 1).
Conclusions: The STAT is both a theoretically and empirically coherent measure of 4 social-communicative behavioral domains. Three of these domains could be sufficient to serve as a predictor of autism severity. The STAT domains are also useful individually; they are brief measures of developmental ability and can provide specific clinical information on social-cognitive challenges for young children. Implications of the different STAT domains as indicators of general autism symptomatology and cognitive ability will be discussed.

127 **142.127** Sensory Hyper and Hyposensitivity to Sensory Stimuli As a Diagnostic Indicator of Autism Spectrum Disorder

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Background:
Research has shown that people living with Autism Spectrum Disorders (ASD) are typically sensitive to sensory stimuli. Unusual sensory interests, either seeking or avoiding sensory stimuli, were thus introduced as a new criterion for ASD (B4) in the DSM-5 (APA, 2013). This criterion is broadly defined asÂ "Hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment (e.g., apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement)" (APA, 2013, p50). The inclusion of this criterion however, lacks empirical validation.
Objectives:
To identify the diagnostic relevance of the inclusion of hypersensitivity and hyposensitivity to sensory stimuli in the DSM-5 criteria for ASD
Methods:
Data from 245 clients (171 males, 74 females) who were referred to a local private practice for an autism assessment were extracted by the author from clinical report. Two hundred and six of the participants met the DSM-5 (APA, 2013) criteria for ASD, while 39 did not. Participants were between 12 months and 45 years of age, with a mean of age of 9.11 years old (*SD* = 7.18).
Results:
Results indicated that although the B4 criterion had high sensitivity, its specificity was low. Meeting B4 criterion was common among persons who went on to receive an ASD diagnosis (71%). Very few of those who did not meet this criterion went on to receive a DSM-5 diagnosis (2%). It is clear that the sensitivity of this criterion is high but the specificity is questionable with 41% of those who did not receive a DSM-5 diagnosis also meeting B4 criterion. Thus while the majority of persons with ASD experience sensory difficulties, it does not appear unique to this disorder with many people without the disorder also experiencing similar concerns.
Conclusions:
Clinicians need to be vigilant when using B4 as a diagnostic criterion as its presence is not unique to ASD – its absence however is more telling.
Keywords: DSM-5, sensory behaviours

128 **142.128** Sex Differences in ADOS-2 Scores and Classifications Among Verbally Fluent Children with Autism Spectrum Disorder

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Background:
Recent research suggests that females with ASD are at greater risk of not being identified, or for being identified later, than their male counterparts. Because currently available diagnostic and screening measures were developed and validated using primarily male samples, clinicians and researchers have proposed that these measures may lack sensitivity for detecting females with ASD. In particular, there is concern that females with higher cognitive and language abilities, who may be adept at "masking" social-communication difficulties in certain contexts, receive sub-threshold scores on instruments such as the Autism Diagnostic Observation Schedule (ADOS), because the extent of their difficulties is less apparent in clinical settings.
Objectives:
This study examined whether ADOS-2 classifications, domain calibrated scores, or individual item scores differed between verbally fluent males and females with ASD.
Methods:
Participants were drawn from an existing database of clinic and research referrals to the University of Chicago Developmental Disorders Clinic, University of Michigan Autism and Communication Disorders Center, or Center for Autism and the Developing Brain. Participants were selected for the current analyses if they had completed a Module 3, received a NVIQ score >=80, and received a best-estimate final diagnosis of ASD as part of a comprehensive diagnostic assessment. This resulted in a sample of 396 males [age= 8.9 years (2.9), NVIQ= 105(15), VIQ= 100(19)] and 85 females [age= 8.7 years (2.8), NVIQ= 104(15), VIQ= 105(17)].
Results:
Females with ASD were less likely to meet ASD cut-offs on the ADOS-2 Module 3 algorithm (85%) compared to males (94%), X^2 (1, N= 481)= 9.8, p= .002. Furthermore, results of logistic regression showed that even after controlling for age and VIQ, boys had increased odds of meeting ASD cut-offs (OR=2.90, p=.005). Linear regressions tested sex, age, and VIQ as predictors of ADOS overall calibrated scores and domain calibrated scores. Sex significantly predicted overall Calibrated Severity Scores (CSS) (B= -.57, CI 95% -1.08 to -0.06, p= .03) and RRB domain scores (B= -.89, CI 95% -1.4 to -.34, p= .002), but not Social Affect domain scores (B= -.39, CI 95% -.89 to 0.12, p= .13). VIQ had a significant effect on overall CSS (B= -.02, CI 95% -.04 to -.01, p= .000) and Social Affect domain scores (B= -.03, CI 95% -.04 to -.20, p= .000), but not RRB domain scores (B= -.003, CI 95% -.15 to 0.008, p= .55). We also explored item-level differences by sex; items with significant differences are shown in Figure 1.
Conclusions:
Consistent with previous studies, our results indicate that verbally fluent females with ASD exhibit fewer repetitive behaviors than males. While the majority of both males and females with clinical diagnoses of ASD met ASD cut-offs on the ADOS, a larger proportion of females received scores in the non-ASD range. These females still received clinical diagnoses of ASD, indicating that clinicians gathered sufficient evidence of impairments within and/or outside of the ADOS context to justify the diagnosis. However, future research should further investigate when and why some females with ASD are missed by these instruments.

129 **142.129** Sex Differences in Item Specific Analyses of ADI-R in Preschool-Aged Boys and Girls with ASD

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Background: Females are diagnosed with autism spectrum disorder (ASD) at a ratio of one for every four males and are often diagnosed at a later age. Evaluating sex differences in the behavioral profiles of children with ASD at the time of diagnosis may provide insight into why females are often diagnosed at a later age.
Objectives: Females in this cohort had a significantly higher ADI-R social communication algorithm score than males (p = 0.0177). We carried out item specific analyses in reciprocal social interactions (RSI), communication, and restrictive, repetitive, and stereotypical (RRS) behaviors measured on the ADI-R to further investigate this difference. As a secondary analysis, we conducted a median split of males and females by age of diagnosis to compare symptoms in younger versus older males and females.
Methods: Participants include 100 preschool-aged children with ASD (mean age 36.13 months). 50 females (age of diagnosis range 13-41 months; DQ range 29-112; ADOS composite score range 4-10) were matched to 50 males (age of diagnosis range 14-45 months; DQ range 29-113; ADOS composite score range 4-10). The ADI-R, an assessment that evaluates current and previous symptoms of ASD and aids in diagnosis, was administered to parents. To evaluate the effect of age at diagnosis on symptom severity, males and females were divided at the median to define those diagnosed at a younger age (< 30 months) versus a later age (> =30 months). Analysis of variance was used to investigate differences between males and females with ASD and males and females diagnosed at younger versus older ages for each item on the ADI-R algorithm.
Results: There were significant sex main effects in the RSI and communication sections. Within RSI, females were more affected in their failure to use nonverbal behavior to regulate social interaction (p = 0.0070), range of facial expressions used to communicate (p = 0.0071), seeking to share enjoyment with others (p = 0.0014) and quality of social overtures (p = 0.0430). In the communication section, females showed increased impairment in their lack of, or delay in, spoken language and failure to compensate through gesture (p = 0.0203) and in pointing to express interest (p = 0.0437). When evaluating groups split by age, we found these differences were most pronounced in the younger females with ASD relative to females diagnosed at an older age and males of all ages. No significant differences between males and females were observed in any items related to RRS patterns of behavior.
Conclusions: Females diagnosed at a younger age exhibited higher parent-perceived levels of impairment in specific aspects of reciprocal social behavior and communication, suggesting that younger females may need to exhibit greater perceived-impairment for parents to seek a clinical diagnosis. These differences in severity are seen only in the social and communication categories of the ADI-R. In contrast to recent reports showing less severe RRS patterns of behaviors in females with ASD, we did not observe any differences across males and females as measured by the ADI-R.

130 **142.130** Sex Differences in Presenting Concerns and ASD Diagnostic Outcome in a Clinical Sample

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Background: According to the Center for Disease Control and Prevention, approximately 1 in 68 children have been identified with autism spectrum disorder (ASD). There is a higher rate of ASD diagnosis in males than females. ASD is characterized by qualitative deficits in areas of reciprocal social interaction, verbal and non-verbal communication, and the presence of repetitive, stereotyped behaviors and interests. However, males and females have been found to manifest these core symptoms differently. One of the key research priorities in autism research is the identification of early biological and behavioral indicators of ASD; at present, the influence of sex differences on clinical identification and diagnosis of children with ASD is poorly understood.
Objectives: To examine relationships among sex differences in identification of developmental concerns, ASD assessment results, and diagnosis in a sample of patients at a clinic specializing in developmental disorders.
Methods: The study sample included 34 children (26 males:6 females, aged 8+/-3 and 9+/-5, respectively; $t(30)=0.67$, $p=.51$]) referred to a specialty autism clinic within a two year period; data collection and retrospective analyses of additional historical cases are ongoing. All children were administered the Autism Diagnostic Observation Schedule (ADOS). Chi-square statistics were used to evaluate the likelihood of children meeting ADOS criteria for ASD as a function of sex. T-tests compared sexes in terms of age at which parents were concerned and initially sought help. Qualitative chart review examined differences in the nature of parents' concerns, clinical profiles, and diagnostic outcomes by sex.
Results: Girls and boys did not differ in age of first parental concerns (Male: 24.56+/-22.65 months; Female: 21.80+/-14.87 months; $t(28)=0.26$, $p=.80$) or age at which parents sought professional consultation (Male: 32.14+/-25.13 months; Female: 25.60+/-20.01 months; $t(25)=0.54$, $p=.59$). Despite these similarities, girls were significantly less likely to meet criteria for ASD on the ADOS ($\chi 2Â =11.13$, $p=.003$) during their clinic visit. Whereas 81.3% of boys met ADOS criteria for ASD, this was true of only 16.7% of girls. Qualitative chart review indicated parents' first concerns were similar for boys and girls (e.g., speech, social difficulties, atypical behaviors). Among the girls, 2 were given ASD diagnoses, 1 of whom received an ASD diagnosis despite not meeting ADOS criteria. Alternative diagnosis givenÂ to girls included Attention Deficit Hyperactivity Disorder, and description of anxiety, nonverbal learning profile, as well as no diagnosis.
Conclusions: Sex differences were not evident in when parents began to have concerns about their child and when they first brought their concerns to a professional. However, with respect to the identification and diagnosis of ASD, it was found that girls were significantly less likely to meet criteria on the ADOS. These data suggest a discrepancy in the identification between males and females and are consistent with the idea that females may be less likely to get an ASD diagnosis based on conventional diagnostic procedures.

131 **142.131** Special Education Assessment and Classification for Students with ASD: Perspectives of School Psychologists

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Background: With autism spectrum disorders (ASD) in the United States reaching prevalence rates of 1 in 68 (Christensen et al., 2016), public schools are increasingly tasked with assessing students suspected of having ASD. However, special education data suggests many children with ASD are not classified for special education services in the area of ASD (Christensen et al., 2016; Pinborough-Zimmerman, 2012). Specifically in Georgia, 8-year-old children identified with ASD are only given an ASD classification 58% of the time. The next most prevalent eligibility category for students with ASD was significant developmental delay (SDD) at 29% (Christensen et al., 2016).
Objectives: This study examined the reasons special education classification may be established in SDD rather than ASD from the perspective of school psychologists, with a focus on geographical location (i.e., urban, suburban, rural). Further, this study examined the barriers school psychologists encounter when participating in preschool evaluations for children suspected of having ASD.
Methods: The survey for this study was developed by a team of clinicians and researchers to collect school psychologists' assessment procedures for students with ASD. Survey items were ranked by importance from 1-5 and then averaged and ordered by importance (i.e., lower mean ranks indicating higher importance). Differences in mean item ranks across the items and between geographic locations were considered using two-way ANOVA. The survey was emailed to 557 valid email addresses with 300 surveys completed yielding a response rate of 54%. The sample was found to represent approximately 42% of school psychologists in Georgia (U.S. Department of Education, 2016).
Results: The most salient reasons of establishing eligibility in SDD rather than ASD were "Children can qualify in the area of SDD, so an ASD specific evaluation is not needed" ($M = 2.51$) followed by "Parents of preschool children need time to process their child's differences before an ASD eligibility is established" ($M = 3.05$) and "It is difficult to identify ASD in preschool age children" ($M = 3.29$). Geographical location did not influence how participants ranked the reasoning behind eligibility decisions ($p = 0.199$).
The two greatest barriers for school psychologists to participate in preschool ASD evaluations were "Time constraints and scheduling problems to obtain school psychologists" ($M = 2.05$) and "There are not enough school psychologists available to hire to complete these evaluations" ($M = 2.46$). Regardless of geographic location, no significant differences were found in the ranking of barriers ($p = 0.480$).
Conclusions: Across both research questions, geographical location did not appear to influence participant responding, indicating future professional development should be distributed throughout Georgia. Results of this survey may also suggest school psychologists experience apprehension giving a classification of ASD. Although receiving a SDD classification rather than an ASD classification may not impact special education service delivery, it may create diagnostic confusion and decrease access to intervention outside of the school system. Further, although autism can be reliably diagnosed as early as 2- years-old (Lord, et al., 2006), these results suggest school psychologists may encounter barriers when completing these evaluations for young children.

132 **142.132** Stability of Risk Status in Toddlers with Autism Spectrum Disorder before Age 2: A Three-Year Follow-up

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Background:
Autism spectrum disorder (ASD) is thought as an innate and long-life neurodevelopmental disorder and characterized by impaired social communication and social interaction, as well as restricted and repetitive patterns of behavior and interest. Once thought to be a rare disorder, ASD has recently emerged dramatically. The increasing prevalence rate is due to improved awareness of ASD and service availability, and also highlights the importance of the early detecting. Knowing the importance of early detecting, the American Academy of Pediatrics (AAP) has recommended that all toddlers should receive screening for autism before age 2 (Johnson et al., 2007). However, few study examined the stability of risk status in toddlers with ASD before age 2.
Objectives:
Previous studies supported that a diagnosis of children with ASD appears to be stable as young as age 3. However, few studies examined stability and change of diagnosis for toddlers with ASD before age 2, especially for mid-term follow-up study. In this current study, longitudinal design was used to examine stability and change of diagnosis for toddlers with ASD before age 2.
Methods:
There were 63 toddlers participated the study, including 32 toddlers with ASD and 31 toddlers with developmental delay. All toddletrs had administrated both of the Screening Tools for Autism in Two-Year-Olds, Taiwan version (T-STAT) (Chiang et al., 2013) and Autism Diagnostic Observation Schedule (ADOS) (Lord et al., 1999) between 18 and 24 months of age (Time 1, mean chronological age = 21 months) and received follow-up diagnostic and developmental reassessment between 54 and 67 months of age (Time 2, mean chronological age = 58 months). At Time 2, all toddlers were assessed and diagnosed according to DSM and with reference to developmental history and current concerns from parents, results of cognitive and adaptive function measures, observations of the child, and the results of ADOS by a multidisciplinary team that included senior child clinical psychologists with Ph.D. degree and senior child psychiatrists.
Results:
Based on classification of the T-STAT (cutoff = 2.25), the results showed that the sensitivity and specificity are .84 and .81, respectively. In addition, positive predictive value (PPV) is .82 and negative predictive value (NPV) is .83. However, based on classification of the T-STAT (cutoff = 2.50), the results showed that the sensitivity and specificity are .81 and .84, respectively. In addition, PPV is .84 and NPV is .81. Based on classification of the ADOS-module 1 (Time 1), the results showed that the sensitivity and specificity are .88 and .84, respectively. In addition, PPV is .85 and NPV is .87.
Conclusions:
The results of this current study showed that reliable diagnosis of toddlers with ASD could be made before age 2 and have good mid-term stability. In addition, the results of this current study showed that both the T-STAT and ADOS are promising tools to differentiate toddlers with ASD and toddlers with developmental delayed before age 2.

133 **142.133** Standardized Cross-Cultural Assessment of Ability and Disability in ASD: The New WHO ICF-CY Core Sets

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Background:
The International Classification of Functioning, Disability and Health (ICF) by the World Health Organization (WHO) provides a universal framework to describe health-related functioning. The ICF is based on a bio-psycho-social model, comprising over 1600 categories of functional domains:Â body functions, body structures, activities and participation and environmental factors. In order to make the ICF more applicable in certain health conditions, so called “ICF core sets”, that are user friendy,Â empirically derived condensed versions of the ICF with a high fit for a certain diagnosis have been generated. Core set development is based on a rigorous scientific process including four preparatory studies in an international, cross-disciplinary setting: A systematic literature review (research perspective), an expert survey (expert perspective), qualitative study (client and caregiver perspective) and clinical cross-sectional study (clinical perspective). The findings from these studies are evaluated and compressed by a multi-stage voting procedure during an international consensus conference, resulting in the respective core sets.
Objectives:
To report the results of the ICF core set consensus conference for Autism Spectrum Disorder (ASD). Preparatory studies had yielded 168 ICF candidate categories for ASD. This evidence was used as a starting point to generate a Comprehensive, a Common Brief, and three age-specific WHO ICF ASD core sets.
Methods:
Twenty ASD experts, representing all six WHO-regions and various disciplines, were invited to participate in the 3-day consensus conference. The experts followed a three-stage decision-making and consensus process to decide on the ICF categories that should be included in the ICF Core Sets for ASD. In the first stage, the experts prioritized and selected ICF categories to be included in the Comprehensive ICF core set. The second stage consisted of defining the Common Brief core set for ASD. The third stage involved developing age-specific Brief core sets for ASD: ages 0 to 5 years, 6 to 16 and 16+ years.
Results:
Finally, 111 categories were included in the Comprehensive ICF Core Set with 59 categories from the activities and participation component, 31 environmental factors, 20 body functions and 1 body structure. The Common Brief ICF core set included 46 categories; 17 activities and participation categories, 15 environmental factors and 14 body functions. When defining the age-specific Brief ICF core sets, 14 categories were found to be common in all of the age groups. Thus, these 14 categories were added to the common Brief ICF core set, resulting in a set of 60 ICF categories. Together with the 60 Common Brief set categories, the Brief ICF core set for the 0 to 5 age group consisted of 73 categories, while the 6 to 16 age group had 81 categories and the adult group 79 categories.
Conclusions:
When defining the ICF core sets for ASD, a large number of categories were selected across all of the ICF components, supporting the notion that ASD impacts wide ranges of functions and contextual factors in life. From these core sets, assessment tools will be derived for future usage in clinical and research setting as well as health care administration.

134 **142.134** Symptoms of Autism Spectrum Disorder in Individuals with Down Syndrome or Williams Syndrome

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Background: Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by persistent deficits in social communication, as well as restricted, repetitive patterns of behavior (American Psychiatric Association, 2013). Despite past research demonstrating that individuals with Down syndrome (DS) are not impaired on the social domain, and that Williams syndrome (WS) is a polar opposite of autism, individuals with these conditions display an increased prevalence of ASD. Previous research has shown that not only do more individuals with Down syndrome have a comorbid diagnosis of ASD in comparison to the reported CDC prevalence, but many children who do not receive an ASD diagnosis still exhibit elevated ASD symptoms. Research investigating the overlap of WS and ASD has shown that individuals with WS also display an increased prevalence of ASD, and display elevations both on assessments measuring symptoms of autism (Lough et al., 2015), and gold-standard autism diagnostic assessments (Klein-Tasman, Phillips, Lord, Mervis, & Gallo, 2009).
Objectives: The objective of this study is to investigate the overlap of symptoms associated with autism within the Down syndrome and Williams syndrome population, utilizing an autism screener (the Social Communication Questionnaire, SCQ), a dimensional measure of symptoms associated with autism (the Autism Spectrum Rating Scales, ASRS), and an adaptive behavior assessment (the Adaptive Behavior Assessment System, Third Edition, ABAS-3).
Methods: Parents and primary caregivers of children aged 6-18 with either an ASD, Down syndrome, or Williams syndrome diagnosis were asked to fill out an anonymous online survey, which contained demographic questions, as well as the aforementioned assessments. The goal is to recruit at least 28 individuals for each group, and to continue to recruit until we have received 75 per group. Currently, 77 parents of children with DS, 34 parents of children with WS, and 5 parents of children with an ASD diagnosis have completed the survey.
Results: Preliminary analyses show that more individuals with Down syndrome and Williams syndrome screened positive on the SCQ, in comparison to the population prevalence reported in previous research (Chandler et al., 2007). In this sample, 22% of individuals with a DS diagnosis screened positive on the SCQ (5 of the 77 individuals in the sample had a comorbid diagnosis of ASD, and all screened positive on the SCQ). Additionally, 53% of individuals with a WS diagnosis screened positive on the SCQ (4 of the 34 individuals in the sample had a comorbid diagnosis of ASD, and all screened positive on the SCQ).Â Additional analyses will compare the total score on the ASRS to the normative sample mean, examine the role of adaptive behavior in total scores on the ASRS, and compare each group's total scores on the three subscales: social/communication, unusual behaviors and self-regulation.
Conclusions: Â It is our hope that results of this study will shed light on the phenotypic overlap between autism and these genetic conditions, and will develop future directions for new research in how to best screen, diagnose, and create interventions for individuals with DS or WS who also display characteristics of ASD.

135 **142.135** Testing the Utility of Positive, Negative, and Cognitive Dimensions for Parsing ASD Heterogeneity

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Background: Autism spectrum disorder (ASD) is very heterogeneous in its clinical presentation. While gold-standard assessment tools are effective for capturing the general presentation of the disorder and making diagnostic discriminations, there are currently no assessments that parse potentially diverse presentations within symptom domains; instead, existing assessments focus on the general notion of "abnormality." For example, many assessments probe for "atypical prosody," yet, due to broad wording, questions cannot differentiate whether prosody is over-animated and cartoonish versus robotic and monotone. This lack of specificity limits the capacity to characterize phenotypic heterogeneity, which may reflect dissociable underlying biology or relate to different treatment outcomes. In schizophrenia, conceptualizing symptoms along positive, negative, and cognitive dimensions has been fruitful in treatment development (Chen et al. 2013); it has recently been proposed that applying a similar conceptualization to the ASD phenotype could be a meaningful endeavor (Foss-Feig et al. 2015).
Objectives: To test the utility of capturing ASD symptoms along positive (presence of an atypical feature not seen in normative development), negative (decrease or absence of a behavior characteristic of normative development) and cognitive (abnormality in thought processes) dimensions as a way to assess variability within facets that intersect traditional symptom domains and differentially associate with low-level processes.
Methods: A battery of social, language, sensory, and diagnostic assessments was administered to 28 children (age 10-13 years) with ASD. Individual items were selected from the Social Responsiveness Scale (SRS) and Clinical Evaluation of Language Fundamentals Pragmatics Profile (CELF-PP) that best mapped onto the Positive, Negative, and Cognitive dimensions in the social domain (5, 6, 6 items, respectively), as outlined in Foss-Feig et al (2015). Bivariate correlations evaluated whether variability along these new dimensions was dissociable from traditional scales of social dysfunction (ADOS, SCQ), and/or differentially associated with particular subsets of low-level behaviors (sensory hyporesponsiveness, hyperresponsiveness, and seeking).
Results: Neither ADOS Social Affect Score nor SCQ Total Score were significantly correlated with any of the Positive, Negative, and Cognitive dimensions (all p's>.4), indicating that these scales tap new constructs overlooked in gold-standard scales for quantifying social dysfunction. Positive, Negative, and Cognitive scores were differentially associated with specific sensory responses: more positive symptoms correlated significantly with greater levels of social hyperresponsiveness (r=.610, p=.003), nonsocial hyperresponsiveness (r=.564, p=.006), and nonsocial hyporesponsiveness (r=.500, p=.018), whereas negative symptoms correlated positively and significantly only with nonsocial hyporesponsiveness (r=.512, p=.015), and cognitive symptoms correlated *negatively*and significantly with nonsocial hyporesponsiveness (r=-.494, p=.012).
Conclusions: Only 27 of 107 questions across the SRS and CELF-PP uniquely captured symptoms along Positive, Negative, and Cognitive dimensions, indicating that existing scales inadequately measure variability on these dimensions. Despite few suitable questions, our results support the notion that Positive, Negative, and Cognitive symptom scales capture variability in new ways that can begin to deconstruct the heterogeneity of ASD. Future work should move toward development of new measures that capture ASD symptomatology along these dimensions, which may then contribute to new ways of parsing heterogeneity, grouping subsets of ASD, understanding neurobiology of particular phenotypes, and informing targeted treatment.

136 **142.136** The Autism Diagnostic Observation Schedule Calibrated Severity Score Best Measures Autism Diagnostic Symptom Severity in Pre-School Children

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Background: The severity of autism spectrum disorder (ASD) is often measured by co-occurring conditions, such as intellectual disability or language delay, rather than deficits in social interaction, and restricted interests and repetitive behaviors (RRB). The Autism Diagnostic Observation Schedule calibrated severity score (ADOS CSS) was created to facilitate comparison of the diagnostic features of ASD independent of related conditions over time. Previous research found that, compared to the ADOS total score, the ADOS CSS was less influenced by factors such as cognitive and language abilities. Past studies did not include clinical judgment as a measure of ASD severity, nor explore the effect of other variables that may influence ASD severity, such as behavior problems and sleep disturbance.
Objectives: The objective for the current study was to determine whether the ADOS CSS, ADOS total score, or clinical rating of degree of impairment was least influenced by factors other than deficits in social interaction and RRB.
Â Methods: Children 2-5 years old were ascertained for the Study to Explore Early Development (SEED) through birth certificate records and multiple sources that serve children with developmental problems. All children were screened for ASD with the Social Communication Questionnaire upon enrollment. Children who demonstrated ASD risk were asked to complete an in-person developmental assessment that consisted of the ADOS and Mullen Scales of Early Learning (MSEL). Caregivers completed the Autism Diagnostic Interview – Revised (ADI-R), Child Behavior Checklist (CBCL), and Vineland Adaptive Behavior Scales. All children classified as ASD met ASD criteria on both the ADI-R and the ADOS, or met ASD criteria on the ADOS and one of three alternate criteria on the ADI-R.
The clinician who administered the ADOS noted his or her judgment of degree of impairment associated with ASD on a 7-point Likert scale (SEED DOI). The effect of child variables (i.e., CBCL externalizing behaviors, internalizing behaviors, and sleep problems; and MSEL expressive language, fine motor, receptive language, and visual reception skills) on measures of ASD severity (i.e., ADOS CSS, ADOS total score, and SEED DOI) were assessed with three separate linear regression models.
Results: 2,600 children completed a developmental evaluation and 707 met the SEED ASD case definition. The total amount of variance in ASD symptom severity accounted for by child characteristics was 9% for the ADOS CSS, 29% for the ADOS total score, and 38% for the SEED DOI. Higher ratings of autism symptom severity were significantly associated with more internalizing behavior problems and fewer expressive language and fine motor abilities for all three ASD severity outcomes. Expressive language ability contributed to ADOS total score and SEED DOI ratings more than any other variable.
Conclusions: Compared to the ADOS total score and clinical judgment, the ADOS CSS was the least influenced by the effects of co-occurring conditions on the severity of ASD diagnostic symptoms. Our findings are in agreement with past studies and suggest that, among the measures we evaluated, the ADOS CSS is the best measure of core features of ASD in pre-school children.

137 **142.137** The Broader Autism Phenotype in Parents of Children with ASD: A Systematic Review of Studies Reporting the Association Between Parent and Child Phenotype

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Background:
Broader autism phenotype (BAP) is elevated among parents of children with autism spectrum disorder (ASD). Identifying BAP in parents may help create subgroups of children with ASD that can improve efficiency in etiologic research. However, the literature on parental BAP is heterogeneous. Sources of heterogeneity include different measurement tools, varying informant types, which parent is assessed (mother, father, both), the source of the sample/population, and sample size. This variance has prevented clear understanding of the proportion of children with ASD that have parents with BAP and whether parental BAP impacts child ASD phenotype.
Objectives:
We aim to systematically review the literature to highlight and better understand heterogeneity of reported percentage of BAP in parents of children with ASD. Our secondary goal is to synthesize the literature on the association between parental BAP and child ASD phenotype. Better understanding of this relationship will be useful in identifying endophenotypes (specific traits genetic in origin that can parse heterogeneity) that can be used to refine etiologic analyses.
Methods:
We systematically searched Pubmed and Scopus databases in August 2016. Key search terms included ‘broader autism phenotype’, ‘quantitative autistic traits’ ‘parents’, ‘relatives’, and slight derivations of those phrases. Two independent reviewers examined 477 papers by title and abstract, resulting in a full text review of 97 papers. Studies were excluded if they did not measure BAP in parents of children with ASD or did not present dichotomized parental BAP status (BAP+ or BAP-).
Results:
Fifty-seven papers were identified that met criteria. Identified papers used eight different measurement tools, four types of informants, and three types of respondents. Sample sizes ranged from 4 to 3299. Thirty-nine papers reported proportion of parents with BAP, ranging from 3% to 73%. In most studies, the proportion of fathers with BAP was higher than mothers. The Family Health Interview was the most common measure and had the widest range in percentages, which may illustrate changes in the instrument over time or its use across clinical and population based samples. When sample size increased, the proportion of parents with BAP was less than in smaller samples, which may be a factor of sample population (clinic or population based) or difference in the type of measurement tools used depending on sample size. Fourteen studies assessed how parent BAP is associated with child ASD phenotype. These studies showed a relationship between parent restrictive and repetitive behavior and interests (RRBI) and child rigidity. There was also a positive association between parental BAP scores and child scores on ASD screeners. Father’s BAP tended to have a stronger association with child phenotype as compared to maternal BAP.
Conclusions:
BAP is prevalent in parents of children with ASD and there may be an association between BAP in parents and child ASD phenotype. Using BAP as a way to subgroup ASD may improve the efficiently of etiologic studies. Thoughtful consideration should be given when interpreting results of parental BAP studies, as sample type, measurement tool, and parent type may all play a role in effecting estimates.

138 **142.138** The Impact of the Audience Effect and Inattention on Online Vs in-Person IQ Assessment

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Background: In order to facilitate collection of large samples of individuals with Autism Spectrum Disorder (ASD) and typically developing controls (TDCs), we developed an online, computer-adaptive IQ test based on item response theory - the Center for Autism Research Adaptive Test (CARAT; Clements et al., 2015). The online CARAT is self-administered; however, the absence of an examiner may affect performance in at least two meaningful ways for individuals with ASD and/or ADHD. First, individuals with ADHD may show periods of inattention without an examiner to help guide focus, missing some questions they ordinarily would have gotten correct. Second, the presence of another individual can affect one's behavior via the "audience effect," which is believed to be tied to a desire to positively manage one's reputation in front of others. Chevallier et al. (2014) found that examiner administration of a task benefited typically developing controls (TDCs) more than individuals with ASD compared to a computerized version of the test taken alone.
Objectives: Â Examine the effects of administration mode (in-person or computerized) on IQ test performance for individuals with ASD and/or ADHD.
Methods: Â Individuals ages 6-90 will complete both the online CARAT and the in-person WASI-II (n=50 ASD, 50 TDC). We expect a subset of both groups to have ADHD. We will detect "aberrant" responses due to inattention, meaning responses that are unexpectedly incorrect given the examinee's response pattern, by comparing the fit of two ability models that allow different levels of variability (Zoltowski et al., 2016). We previously used this method to successfully detect other types of aberrant responses (e.g., seeking help). We will compare the number of aberrant responses detected in individuals with and without ADHD. To test the impact of the audience effect, we will analyze the interaction between diagnostic group (ASD and TDC) and type of test (computerized CARAT or in-person WASI-II).
Results: Â To date, 24 TDC individuals between ages 7 and 53 (mean(sd) age = 24.7(12.6) years) have completed this testing, and WASI-II Full Scale IQ scores ranged from 86 to 136 (mean(sd) IQ score =114.1(15.6)). The remaining sample will be recruited in time for analysis and presentation by May 2017, and results in either direction will provide information about the appropriateness of online testing for different diagnostic groups.
Conclusions: As online tasks become increasingly popular in the field of ASD research, it is important to understand how different testing formats affect performance for people with autism and inattention. These analyses may help researchers determine how to interpret results from self-administered tasks and how to identify aberrant responses to items. The variability analysis may be able to detect individuals who have greater difficulty sustaining attention during online assessments so that researchers can implement supports for these situations, or rescore the measure removing aberrant responses. Furthermore, computerized testing may either provide a more equal testing environment, if we find that the audience effect boosts performance of TDC individuals, or may not affect group differences reported in examiner-administered tasks. Extensions of these approaches could be applied to other online tasks.

139 **142.139** Correspondence of Parent and Trained Observer Reports of Social Skills and Autism Symptoms

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Background:
It has been documented that in the child population, discrepancies often exist among different informant's ratings of child psychopathology and these discrepancies have an impact on assessment, classification, and treatment.Â Very little research has examined rater discrepancies, particularly in populations of children with developmental disorders.
Objectives:
The first objective of the study was to determine the consistency of parental reports of autism symptoms and social skills.Â This study also aimed to investigate the level of disparity between parent and trained observer reports of social skills and autism symptoms.
Methods:
The sample consisted of sixty-eight elementary school-aged children who were participating in a randomized treatment trial (M = 9.9 years, SD = 1.8) diagnosed with high functioning autism spectrum disorder (IQ above 85).
The parent report measures examined were the Autism Diagnostic Interview Revised (ADI-R) and the Social Responsiveness Scale (SRS). The ADI-R is an audio taped semi-structured interview organized around DSM-IV and ICD-10 diagnostic criteria for autism, and the SRS is a 65-item rating scale parent report measure of children's social impairments in naturalistic social settings.
The trained observer measures examined were the Autism Diagnostic Observation Schedule (ADOS) and the Playground Observation of Peer Engagement (POPE). The ADOS is a semi-structured autism diagnostic assessment tool and the POPE is a behaviorally based timed interval behavior coding system that measures peer engagement in natural environments.
Results:
Pearson correlations were performed between parent and trained observer ratings. There was a nonsignificant correlation (r = .08, p = .491) between measures of autism symptoms reported by parents (ADI-R) and those rated by trained observers (ADOS). Similarly, a nonsignificant correlation (r = -.175, p = .144) was found between measures of social skills reported by parents (SRS) and those rated by trained observers (POPE). In a secondary analysis, we found a significant correlation (r = .529, p < .001) between the parent report of autism symptoms (ADI-R) and parent report of social skills (SRS). At the subscale level, ADIR-restricted, repetitive, and stereotyped patterns of behavior significantly correlated with SRS-total (r=.264, p=.008), SRS-communication (r=.210, p=.035), SRS-motivation (r=.239, p=.016) and SRS-mannerisms (r=.382, p=.000).
Conclusions:
Parent and trained observer reports of autism symptomatology and social skills were not found to be consistent with one another. Greater child impairment reported by parents did not equate to worsened performance ratings granted by clinicians. Our findings provide support for the idea that parent report is not in line with eventual diagnostic outcome. Our results of the comparison between SRS and ADI-R indicate that parent report of ASD symptomatology and behaviors remained consistent across report type. Specifically, the information gathered during the semi-structured interview was reflected in the parent self-report measure. It is important to further investigate the lack of a relationship between parent and trained observer reports, given the need for accurate information to create clinical profiles and deliver effective treatments.

140 **142.140** The Predictive Value of AQ and SRS-a in Adults with Suspected ASD

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Background:
ASD questionnaires are often used as screeners in the assessment of adults with suspected ASD. Their diagnostic value depends on their capability to properly assess the likelihood that the disorder is present (sensitivity: true positives) or not (specificity: true negatives).
In clinical practice, the AQ (Autism Quotient, open source) and the SRS-A (Social Responsiveness Scale - Adults, paid source) are most often used as tools for quantitative autism assessment. Their predictive value for diagnostic classification has seldom been compared.
Objectives:
The aim was to study the predictive value of the AQ and the SRS-A for diagnostic classification in a general mental health care population.
Methods:
The adult patients, who were referred for ASD assessment, filled in both an AQ (max score = 50) and a SRS-A (max score = 192) self-report at the beginning of the diagnostic process. An independent researcher scored these questionnaires. The results remained unknown to the diagnostician and the patient until after the ASD diagnosis was officially confirmed or rejected, resulting in an ASD-group and a non-ASD group. In total, there were 92 participants (M = 33.51 years, SD = 12.33), of which 68% received an ASD diagnosis. The ASD and non-ASD group did not differ on important characteristics, such as age (M = 33.68 vs. M = 33.14) and gender ratio (1.3:1 vs.1.4:1). T-tests and ROC-analyses were performed.
Results:
The ASD group had significant higher scores than the non-ASD group on both the AQ (M = 29.17, SD = 7.75; M = 20.97, SD = 8.13 respectively; t = 4.65, df = 90, p < .001, Cohen's d = 1.03) and SRS-A (M = 70.87, SD = 10.76; M = 63.59, SD = 12.56 respectively; t = 2.86, df = 90, p < .01 Cohen's d = 0.62). The correlation between both questionnaires was high (r = .80, p < .001).
The ROC-analysis for the AQ yielded an AUC of .78 (p < .001) for ASD vs. non-ASD. A cut-off score of 26 (as recommended for clinical use, but also determined by the best Youden's Index in this research) had a sensitivity of .76 and a specificity of .72 for ASD. The ROC analysis for the SRS-A yielded an AUC of .69 (p < .01) for ASD vs. non-ASD. A cut-off score of 70 (determined by the best Youden's Index) had a sensitivity of .63 and a specificity of .72 for ASD.
Conclusions:
Both questionnaires could differentiate between the ASD and the non-ASD group. However, the AQ had a higher effect size (large vs. medium), a better predictive reliability (moderate vs. poor) and a higher sensitivity. Thus, based on the current results, the AQ seems to be superior as a screening tool for general mental health care patients with suspected ASD. However, replication studies are needed before advising which one to use for clinical practice. Also, note that questionnaires are not intended to be diagnostic in itself. If there are clinically significant levels of autistic traits, a comprehensive diagnostic evaluation is warranted.

141 **142.141** The Predictive Value of the M-CHAT for ASD Screening Among Preterm Infants

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Background: The prevalence of Autism Spectrum Disorder (ASD) is 1% in the general population, whereas among preterm born children it is estimated as 1%-8%. Therefore, special attention has been given to early identification of social-communication deficiencies and ASD-symptoms in this high-risk population.
The Modified Checklist for Autism in Toddlers (M-CHAT) is a widely used screening instrument for ASD. The rate of positive screening for risk for ASD among preterm born children is 20%-41%, and is significantly higher compared to that of full-term infants.
Abnormal scores on the M-CHAT correlate with lower socio-economic status, male gender, low birth weight and gestational age, as well as with sensory, motor, social-communication, cognitive and emotional impairments. Given the association among the M-CHAT and the aforementioned characteristics, the predictive value of the M-CHAT should be carefully assessed utilizing gold standard measures.
Objectives: To examine the sensitivity and specificity of the M-CHAT administered at 18 months, concurrently at 18 months and predictively at 36 months among preterm born children.
Methods: One hundred and ten preterm infants (Demographic characteristics are presented in Table 1) participated in this longitudinal study. The Mullen Scales of Early Learning, the M-CHAT and the Autism Diagnostic Observation Schedule (ADOS) were administered at 18 and 36 months.
Among 110 infants in our sample, 3 infants were excluded from the analyses because of severe neurological impairments. Eighty-nine families completed the assessment at 18 months, and 81 completed the assessment at 36 months.
Results: Applying the recommended criteria for the M-CHAT at 18 months, 29 infants (32.6%) screened positive for risk for ASD whereas only 8 infants (9.0%) were identified at risk for ASD using the ADOS. At 36 months, only 2 (2.5%) infants passed the cutoff for ASD diagnosis using the ADOS.
The sensitivity of the M-CHAT conducted at the 18 months in comparison to the ADOS administered concurrently was 62.5%, and the specificity was 70.4%. Assessing the predictive value of the M-CHAT administered at 18 months in comparison to the ADOS administered at 36 months, the sensitivity was 100.0%, and the specificity was 69.6%. The sensitivity of the ADOS administered at the 18 months in comparison to the ADOS administered at 36 months was 100.0%, and the specificity was 93.7% (Table 2).
One-Way ANOVAs indicated that infants who screened positive for ASD by the M-CHAT at 18 months were more likely to be male, from lower income families, and had lower receptive and expressive language abilities at 18 months compared to infants who screened negative. At 36 months, infants who screened positive for ASD at 18 months, exhibited significantly lower fine-motor skills and receptive language abilities and a higher (worse) ADOS total score.
Conclusions: In line with previous reports, positive screening for risk for ASD by the M-CHAT was associated with characteristics not specific to ASD. Given the importance of early intervention, the M-CHAT may be useful in identifying infants who can benefit from intervention yet clinicians should be careful in suggesting risk for ASD, especially among high-risk groups such as preterm infants.

142 **142.142** The Primary Modification of the Chinese Version of Autism Spectrum Quotient- Children's Version (AQ-C)

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Background: The Autism Spectrum Quotient-Children's Version (AQ-C) is a parent-report instrument developed to measure autistic traits in children aged 4-11 years. A Mandarin Chinese translation of the AQ-C is needed for use in research in mainland China.
Objectives: Â To develop a Mandarin Chinese translation of the AQ-C, and to test its psychometric validity.
Methods: A total of 536 participants were assessed. A general population sample of 510 children (6.46±1.628 years of age) were recruited from kindergartens and primary schools. 26 autism spectrum conditions (ASCs) were recruited from hospital (5.85±1.434 years of age). Items were eliminated according to the critical ratioÂ and the change of Cronbach's alpha (α). The structure of the AQ-C was tested using exploratory factor analysis. The childhood autism spectrum test (CAST) and social responsiveness scale (SRS) were used for the validity of the AQ-C.
Results: Â A 31-item, 5-factor model achieved adequate goodness of psychometric characteristics, explaining 43.8% of the variance. The five factors were named mindreading, socialness, patterns, imagination and attention switching, respectively. The correlations between scores of the full scale and these factors were 0.776, 0.441, 0.475, 0.342 and 0.569. The Cronbach's α of the full scale was 0.742, and the five subscales' α ranged from 0.500 to 0.788. The total score was highly correlated with CAST and SRS (r=0.520, 0.587; *P*<0.001). ASCs scored significantly higher than the general population (ASCs: 53.58±9.97, general population: 34.18±9.15; *t*=10.49, *P*<0.001).
Conclusions: Â The Chinese AQ-C showed favorable reliability and validity in the preliminary analysis. Confirmatory factor analysis of a larger sample size is warranted.

143 **142.143** The Relationship Between Socialization and Externalizing Problems in ASD and VCFS

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Background:
Addressing both core symptoms of autism spectrum disorder (ASD) and associated symptoms of ASD has become increasingly important (Lord & McGee, 2001). A commonly associated feature of ASD is that individuals often exhibit externalizing problems (Volker et al., 2010). It is important to understand the relationship between externalizing problems and core symptoms of ASD.
Objectives:
To examine whether social functioning uniquely predicts externalizing problems in ASD, in relation to typically and atypically developing populations.
Methods:
125 children and adolescents participated in this study: 34 with ASD, 34 typically developing (TD), and 58 with Velocardiofacial (VCFS / 22q11) syndrome. All diagnoses of ASD were confirmed using the ADOS-2, the ADI-R, and clinical judgment and VCFS diagnosis was confirmed with FISH analysis. Participants with VCFS did not have a comorbid diagnosis ASD, based on the ADI-R.
Externalizing behaviors were assessed with the BASC-2 Parent Rating Scale while social functioning was assessed with the socializations scores on the Vineland-II. IQ was measured by the WASI-II in the ASD and TD groups and by the WISC-III or the WAIS-IV in the VCFS group.
The ASD and TD groups were matched on chronological age (within 12 months) and Full Scale IQ scores (within one standard deviation) on the WASI-II.
Results:
Linear regressions assessed whether Socialization scores predicted Externalizing Problems. IQ was not significantly correlated with either measure in the ASD or TD groups and was thus not included in the regression. IQ was a significantly related to Socialization for the VCFS participants and was entered into the regression first.
For the ASD group, but not the TD group, socialization significantly predicted externalizing problems, $\beta = -.619$, $P < .001$, and socialization explained a significant proportion of variance (38.4%) in externalizing problems scores, $R^2 = .384$, $F(1,32) = 19.93$, $p < .001$.
For the VCS group socialization, but not IQ, significantly predicted externalizing problems $\beta = -.328$, $P < .001$, and socialization explained a significant proportion of variance (62.6%) in externalizing problems scores, $R^2 = .626$, $F(1,55) = 35.499$, $p < .001$.
Conclusions: Â
Socialization abilities significantly predicted externalizing behaviors in both participants with ASD and VCFS. These results can inform assessment and such that interventions targeting externalizing behaviors should focus on promoting social functioning as well. This relationship does not appear to be unique to ASD, as it also occurs in participants with VCFS.Â

144 **142.144** The Role of Feature Engineering in Developing Clinical Diagnostic Machine Learning Algorithms for ASD Screening

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Background: Supervised machine learning (ML) methods are used to train models that map multi-dimensional numerical data to categorical target variables, given a labeled data set. This type of ML has been recently applied to the problem of predicting ASD diagnosis from gold standard measures such as the Autism Diagnostic Observation Schedule. However, these types of assessments are time- and resource-intensive. To demonstrate reasonably accurate predictions using ML methods on a reduced data set would provide immediate value for clinicians and families alike in the form of patient queue sorting and more rapid feedback.
Objectives: In this work, we present the design and performance of ML models trained on clinical diagnostic data to predict the presence or absence of ASD, using the labels *ASD* and *Non-ASD*, respectively. We first identify a small subset of features to be used in model training, thus reducing the number of items required to make predictions. Second, we use feature engineering methods to craft composite features that are more explanatory than their individual components. Finally, we train decision tree ML models and report on their performance for a variety of analyses.
Methods: Â A database of best-estimate clinical diagnoses for toddlers observed using the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) was used for model training. This data set contained N=737 samples (514 *ASD* and *223 Non-ASD*) and 41 features. Dozens of engineered features were created based on exploratory analysis of the data. The most discriminating feature among these was the distance of the data point to the *Non-ASD* median centroid, which was composed of the medians of ADOS-2 codes A2, B1, and B5 for the *Non-ASD*subset.
Results: Â The metric unweighted average recall (UAR) has been suggested as a more robust measure of a model's reliability than true-positive rate (accuracy), particularly in the presence of unbalanced data. To compare the performance of our reduced feature set to the gold standard measures, we trained a model on the full set of ADOS-2 codes (accuracy=90.5%, UAR=0.89) and another model solely on the ADOS-2 total (accuracy=93.1%, UAR=0.92). Our best performing model using only 7 features (the three components of the *Non-ASD* median centroid and ADOS-2 codes A3, D1, D2, and D5) yielded comparable results (accuracy=92.4%, UAR=0.90), and an even simpler model using just 3 features (*Non-ASD* median centroid distance) demonstrated respectable results with just 7.3% of the available feature set (accuracy=91.32%, UAR=0.88).
Conclusions: Using the principles of feature engineering, we demonstrated that some composite feature (e.g., distance to Non-ASD median centroid) outperformed their component features in predicting best-estimate clinical diagnosis. Moreover, we showed that a small subset of ADOS-2 codes had comparable prediction power to the full set of codes, as well as to the ADOS-2 total score. These findings support the claim that a simplified clinical diagnostic tool may be used to facilitate faster turnaround times for clinicians, patients, and their families.

145 **142.145** The Role of Presence of ASD Symptoms in the Variability Between Parent and Teacher Ratings of Social Skills in School-Age Children Evaluated for ASD

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Background: When assessing children for autism spectrum disorder (ASD), clinicians often utilize measures from multiple informants to get a comprehensive picture of the child's functioning. Clinicians may gather information from both parents and teachers; however, variability may exist between informants due to factors such as informant bias and differences between settings (Ducekot et al., 2015). Whereas factors such as the child's age, gender, and IQ have been shown to predict variability between informant reports (Stratis & Lecavalier, 2015), little research has examined how high/low symptoms of ASD relates to this variability.
Objectives: The current study explores: 1) If parent- and teacher-reports of symptoms in school-age children evaluated for ASD are correlated; 2) If not, does presence of ASD symptoms (i.e., high; minimal-to-no) serve as a moderator of the relation between parent- and teacher-reports, after controlling for previously established covariates (i.e., child age, gender, IQ).
Methods: Parents, teachers and clinicians completed study measures for 43 children (ages = 3-16; 22 received an ASD diagnosis; 21 received other diagnoses) as part of an ASD evaluation at a university-based clinic. Parents and teachers completed the Social Responsiveness Scale (First or Second Edition; SRS), assessing social behavior deficits associated with ASD. Clinicians completed the Childhood Autism Rating Scale, Second Edition (CARS-2), assessing behaviors associated with ASD. Multiple regression was conducted using PROCESS for SPSS (Hayes, 2013) predicting teacher-reported SRS scores from parent-reported scores, while controlling for the child's age, gender, and IQ, and including CARS-2 scores as a moderating variable.
Results: Preliminary analyses revealed no significant correlation between parent- and teacher-reported social behavior deficits (SRS; r = .084, p = .592).Â When predicting teacher-reported SRS scores via multiple regression analysis, the addition of CARS-2 and parent-reported SRS scores in Step 2 did not account for significant variance over and above covariates, ΔR^2 = .13, $\Delta F(2, 37) = 2.99$, p = .06. However, the interaction term (parent-reported SRS scores X CARS-2 scores) entered in Step 3 accounted for significant variance in teacher-reported SRS scores, ΔR^2 = .10, $\Delta F(1, 36) = 5.68$, p = .02. Specifically, a significant positive relation emerged between parent- and teacher-reported SRS scores when high symptoms of ASD were present (high CARS-2), yet a non-significant relation emerged between parent- and teacher-reported SRS scores when minimal-to-no symptoms of ASD were present (low CARS-2; Figure 1).
Conclusions: Clinician-reported levels of ASD symptoms moderated the relation between parent- and teacher-reported deficits in social behavior. Although parent- and teacher-reports on the SRS are similar when symptoms are high, they are not related in children with minimal-to-no symptoms as observed by clinicians. This suggests that when ASD symptoms are more severe, agreement among raters is consistent; however, children with minimal-to-no symptoms are likely to have varying reports between parents and teachers. Identifying this non-significant relation present in reports of children with minimal-to-no symptoms helps to identify another potential predictor of report variability. Future studies will be needed to determine the potential reasons for this discrepancy in children with minimal-to-no symptoms.

146 **142.146** Unsupervised Data-Driven Stratification of Autism Based on ADI-R Symptom Domains

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Background:
Autism spectrum disorders (ASD) are clinically and etiologically heterogeneous. Pushing research forward towards precision medicine goals requires a deeper understanding of how individuals and subgroups within ASD are distinguished. Such distinctions within ASD may then point towards more precision in terms of clinical research and practice (e.g., aid in clinical practice for assessment, diagnosis, prognosis, planning treatment, monitoring, etc.) and may pave the way forward for translational research endeavors such as identifying etiological mechanisms and discovering novel targets for treatment.
Objectives:
To utilize unsupervised multivariate data-driven tools to aid in discovery of ASD subgroups defined by different patterning of symptom severity across social, nonverbal, verbal and repetitive restricted behavior (RRB) domains from ADI-R algorithm.
Methods:
ADI-R data was identified for n=3,380 ASD individuals across 72 independent datasets within the National Database for Autism Research (NDAR). Each individual had complete data across all algorithm items in the social, nonverbal, verbal, and repetitive restricted behavior domains. Domain totals were computed as the sum of all algorithm items within these domains. The dataset was split randomly in half within each of the 72 datasets to generate independent Discovery and Replication datasets (n=1,690 in each). We then utilized a hierarchical clustering tools commonly applied within genomics and systems biology analyses such as weighted gene co-expression network analysis (WGCNA), and applied it to the subject dimension of this dataset to identify ASD subgroups in an automated and unsupervised fashion (Lombardo et al., 2016, Scientific Reports). Euclidean distance was used as the distance metric and hierarchical clustering was implemented with the Ward linkage method. Subgroups were automatically identified using a dynamic hybrid tree-cut algorithm with a deepSplit parameter set at 1. Once subgroup clusters were identified we descriptively report symptom severity for each subgroup in each domain as a percentage of the maximum total score one could theoretically obtain across all items in that domain.
Results:
Across both independent Discovery and Replication datasets, we find evidence of 5 replicable ASD subgroups with near identical patterns of symptom severity across the domains. Four of the 5 subgroups could be differentiated on-average by degree of severity and had relatively similar levels of severity across domains. However, there was one subgroup that was distinctly different from all others, with a pattern of high levels of social and nonverbal symptom severity, but relatively large drop-offs in severity on verbal and RRB domains.
Conclusions:
Utilizing unsupervised data-driven tools for discovery of replicable ASD subgroups based on ADI-R symptom severity highlights 5 distinct subgroups. We will next examine how some of these subgroups may be identified and dissociated in further independent datasets (ABIDE, MRC AIMS, EU-AIMS LEAP), which have biological (e.g., resting state fMRI) and cognitive data collected on the same individuals.

147 **142.147** Use of Crowd-Sourcing to Assess Social Communicative Behavior in Toddlers with and without ASD

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Background:
Social communication deficits are key behaviors associated with Autism Spectrum Disorders (ASDs). The assessment of these behaviors is complex and requires highly trained experts especially in very young children. Current practice standards assume that only experienced professionals can assess differences in social communication among young children. Consequently, waitlists are often long in most communities. The technique of crowd sourcing has been used to efficiently answer problems requiring human intelligence. It relies on the concepts of collective intelligence, i.e., that large groups of individuals can create solutions equal in quality to a few experts.
Objectives:
To compare ratings of toddlers' social-communicative behavior as judged by crowd-workers with those made by clinicians with expertise in ASD. We hypothesized that the crowd-sourced assessments would differentiate between varying abilities of social communication in a manner similar to expert-based assessments.
Methods:
A single video clip for each of eight, 18-month-old children participating in a longitudinal research study were selected for this study. All videos showed a child engaging with an adult during administration of the Screening Tool for Autism in Toddlers (STAT). The videos were chosen to show a range of typical and atypical behaviors during simple play-based activities. A 12-item Likert-based questionnaire was created to identify a range of behaviors that might be observed in 18 month old children, with the sum of the 12 items used as an aggregate score and higher scores indicative of more typical behavior. An additional question included a global judgement of whether or not the toddler's behavior was typical for his/her age. Each video was viewed by 3 experts and at least 68 crowd-workers. We assessed inter-rater reliability between expert ratings with an intra-class correlation coefficient (ICC). Rank order mean aggregate scores for each video clip were compared between crowd-workers and experts using a Spearman correlation coefficient. We used a Mann-Whitney U test to compare the aggregate score between clips that were rated as typical versus atypical.
Results:
Spearman correlation for rankings of total social communication behavior between crowd-workers and experts was very high (0.93; $p<0.001$) (See Fig.1). Inter-rater reliability between expert raters was excellent (ICC = 0.80. Crowd-workers completed 587 reviews in 6 hours and 50 minutes. Expert reviewers completed 24 reviews in 57 days. Aggregate summary scores were higher for videos rated as typical behavior than those rated as atypical for both crowd-workers (median score: 43 vs. 33; $p<0.001$) and experts (median score: 49 vs. 32; $p<0.001$).
Conclusions:
In this pilot study, we demonstrated the feasibility and validity of using a crowd-sourcing approach to measure social communication behaviors in very young children. Such a method may be a useful additional screening tool to discriminate typical from atypical behavior rapidly, with the goal of improving specificity of screening for developmental delays in social communication. Further studies with larger populations will be needed to confirm the utility of this approach.

148 **142.148** Use of the Systematic Observation of Red Flags (SORF) for Autism Spectrum Disorder in a Naturalistic Home Setting

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Background: While routine universal screening for autism spectrum disorder (ASD) is critical to allow timely initiation of intervention, some have expressed skepticism due to the lack of effective screening tools available (Al-Qabandi et al., 2007; Campos-Outcalt, 2011). Improved screeners are needed that not only effectively identify children at risk, but also offer increased feasibility for widespread use across community settings. The Systematic Observation of Red Flags (SORF) is an observational measure that has been shown to effectively detect risk for ASD when used with the Communication and Behavior Scales (CSBS) Behavior Sample (Dow et al., 2016). Because many children with developmental concerns do not receive a clinic evaluation, adapting this tool for use in the home could improve community-viable screening options accessible to more families, decreasing the age of diagnosis.
Objectives: To examine use of the SORF in the home for 16-24 month olds, including (1) diagnostic group differences and item-level performance of SORF items, and (2) sensitivity, specificity, and appropriate cutoff scores.
Methods: Preliminary analyses were conducted on the current sample of 32 participants (10 with ASD, 15 developmental delayed, 7 typically developing) recruited by the FIRST WORDS® Project at Florida State University. A sample size of 194 is estimated at the time of presentation, sufficient to achieve a medium effect size and power of 0.80. Children will be included if they have (1) a completed SORF based on behavior during a video-recorded home observation between 16-24 months, and (2) a concurrent diagnostic evaluation to confirm or rule out ASD.
Receiver operating characteristic (ROC) curves were used to evaluate individual items and summary scores, including the Total score of all summed items, Number of Red Flags (RF) score of the number of items indicating clear symptom presence, Social Communication (SC) score of SC items summed, and Restricted and Repetitive Behavior (RRB) score of RRB items summed. Area under the curve (AUC), sensitivity, specificity, and cutoffs were examined. Further analyses utilizing analysis of variance (ANOVA) will also be completed for the full sample to examine diagnostic group differences in items and summary scores, and a Composite score comprised of the best performing items will be created for optimal performance.
Results: Preliminary results suggest excellent discrimination between ASD and nonspectrum groups for the Total (AUC=.97), RF (AUC=.93), SC (AUC=.93), and RRB (AUC=.91) scores. High sensitivity and specificity was found for the Total, RF, and SC scores (sensitivity=.90, specificity≥.96) with appropriate cutoffs. The best performing items were poor directed eye gaze (AUC=.89), limited conventional gestures (AUC=.86), greater interest in objects than people (AUC=.86), repetitive speech/intonation (AUC=.83), limited coordinated nonverbal communication (AUC=.81), and limited consonant sounds (AUC=.80).
Conclusions: Preliminary results are promising indicating that the SORF may provide an effective observational screening tool in the home context, though the full sample is needed to support these findings. The Total and RF scores provided good discrimination, sensitivity, and specificity, and the SC domain may offer an abbreviated measure when used independently with similar effectiveness.

149 **142.149** Using Social Behavior Profiles to Predict Autism and Schizophrenia Diagnoses

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Background: Overlapping social impairments in Autism Spectrum Disorder (ASD) and Schizophrenia (SCZ) contributed to decades of diagnostic confusion that continues to this day in some clinical settings. Our previous work used discriminant function analysis (DFA) to classify the social skills profiles of typically-developing (TD) adults and those with ASD and SCZ based upon their behavior during a 3 minute social interaction. Seven discrete social behaviors were coded: interactive behaviors (e.g., asking questions), nonverbal behaviors (e.g., gaze, affect expression), paralinguistic behaviors (e.g., verbal clarity), appropriate verbal content, repetitive movement, repetitive verbal content, and amount of time speaking. DFA profiles separated ASD ($p < .001$) and SCZ ($p = .041$) from the TD group, with ASD uniquely characterized by fewer interactive behaviors and more repetitive behaviors, and SCZ characterized by greater impaired gaze and flat/inappropriate affective responses.
Objectives: The current study tested our model's predictive accuracy in classifying both the original sample and a new sample of ASD, SCZ, and TD individuals based on their social behavior.
Methods: The original sample consisted of three adult groups: ASD (n=54), SCZ (n=54), and TD (n=56) comparable on age (group mean range: 25.69-28.67), gender (87% male), race (80-91% Caucasian), and IQ (group mean range: 103-106). DFA was used to classify a second unmatched sample (ASD n=28, TD n=31, SCZ n=16).
Results: Seventy percent of ASD and 70% of TD but only 33% of SCZ cases were correctly classified using the original sample. When applied to the second sample, TD classification accuracy increased to 87%, but decreased to 46% for ASD and 18% for SCZ. To explore this classification inaccuracy, we examined comparability in the two samples. The ASD cases in the second sample were younger than the initial sample (p=.010)—many were recruited from a university setting—and exhibited better interactive behaviors and poorer paralinguistic behaviors than the original sample ($p's$<.02). The second sample of SCZ individuals had more females and lower IQ ($p's$<.045) than the first sample, and demonstrated more repetitive movement (p=.01).
Conclusions: Group separation based on social behavior between ASD, TD, and SCZ individuals in an initial sample accurately predicted 70% of ASD cases but only 33% of SCZ cases. This disparity suggests that unique features of ASD (e.g., repetitive behavior) may aid in classifying ASD correctly, whereas differentiating SCZ from ASD based solely upon observable social behavior is less successful. Further, when the classification system was applied to a new sample, it proved accurate only at classifying TD individuals, with reduced classification accuracy for ASD and SCZ individuals. This may have occurred because the second sample of clinical participants was notably distinct from the original sample—ASD participants were younger and more skilled, and the SCZ group had lower IQ and more females. The failure of the model to predict clinical status within a novel sample suggests that social behavior within these clinical groups varies as a function of sample heterogeneity, and thus the model may be of limited utility in clinical settings, particularly those that evaluate diverse clinical populations.

150 **142.150** Using the Social Attention and Communication Surveillance Revised (SACS-R) in a Community Based Setting.

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Background:
Social Attention and Communication Surveillance (SACS) was designed to prospectively identify children developing Autism Spectrum Disorder (ASD) between 12- to 24-months of age. This tool has 81% positive predictive value and an estimated 83.8% sensitivity and 99.8% specificity (Barbaro & Dissanayake, 2010). Five key behavioural markers identified at 12-, 18-, and 24-months of age as most predictive of an ASD diagnosis (Barbaro & Dissanayake, 2012) were incorporated into a revision of the SACS (SACS-R), where a child is considered as having a high-likelihood of developing ASD if s/he is noted as 'atypical' on three out of five key behavioural markers.
Objectives:
The aim in this study was to examine the effectiveness of key SACS-R items in differentiating children with/without autism in a community based setting.
Methods:
The SACS-R was implemented by Maternal and Child Health (MCH) nurses across eight councils in Melbourne, Australia. Children identified as having a high-likelihood of developing ASD on SACS-R were assessed by clinical experts at La Trobe University using the ADOS, ADI-R, and Mullen Scales of Early Learning. Of the 273 children referred and assessed to date, 199 met criteria for ASD. Nurse completed SACS-R data was available for 96 children at 12-months (24 high-likelihood), 159 children at 18-months (76 high-likelihood), and 204 children at 24-months (115 high-likelihood). Fisher's exact test was used to determine whether the key items at each age point were able to discriminate between children with/without ASD. Binary logistic regression analyses were used to determine whether scoring above the SACS-R cut-off predicted a diagnosis of ASD after controlling for gender and age.
Results:
No significant differences were found at 12-months of age between children with/without ASD on the frequency of atypical responses on the key items, and there was no significant association between scoring above the SACS-R cut-off and receiving a diagnosis of ASD. At 18-months of age, a significantly higher proportion of children with ASD than those without were rated as 'atypical' on all five of the key items (i.e. pointing, eye contact, waving, showing, and pretend play), and those scoring above cut-off were 3.5 times more likely to receive an ASD diagnosis. A higher proportion of children with ASD were given 'atypical' scores on four out of five of the key items (i.e. pointing, eye contact, waving, and pretend play) at 24 months of age, and those above cut-off were 3.4 times more likely to receive an ASD diagnosis.
Conclusions:
Previous clinical research has identified SACS as the most accurate and sensitive method for the early detection of ASD. The results from this study illustrate that when rated by community based clinicians, SACS-R does differentiate between children with/without ASD at the 18- and 24-month assessments. However, administration by nurses at 12-months did not significantly discriminate children with/without ASD. As these items were previously shown to differentiate between children with/without ASD when rated by a clinical expert (Barbaro & Dissanayake, 2013), additional education is required on the administration and accurate scoring of these items at 12-months for community-based professionals.

151 **142.151** Utility of Early Communication Assessment within ASD Diagnostic Evaluations in the Second Year of Life

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Background:
The AAP continues to support screening, early diagnosis, and timely referral for intervention, yet there is a lack of readily used standardized assessment instruments specific and sensitive enough to detect ASD red flags and inform intervention prior to comprehensive ASD evaluation. Parents often cite speech concerns early on, leading many families to seek a speech-language evaluation prior to comprehensive ASD evaluation (Chawarska, Paul, Klin et al., 2007), positioning speech-language pathologists (SLPs) at the front lines for detecting and quantifying ASD red flags in toddlers. Paul (2014) emphasizes that measuring frequency, range, and means of communication is necessary to capture a child's current communication abilities at the prelinguistic phase, while simultaneously measuring unusual communicative patterns (echolalia, significant deficits in pragmatics and receptive language). Further, the ASHA Ad hoc Committee on ASD (2006) states that SLPs play a critical role in screening, early detection of children at-risk for ASD, and referrals for further evaluation, while also formulating intervention specific to social communication delays. Additionally, given the complexity of ASD, varied levels of functioning, and need to distinguish ASD from other disorders, interdisciplinary collaboration within the diagnostic process is considered best practice.
Objectives:
To examine how early communication assessment, using the CSBS-DP, correlates to the ADOS-2 Toddler Comparison Score within an ASD diagnostic evaluation, among 2 diagnostic groups: ASD and language delay (LD).
Methods:
54 toddlers, ages 14-24 months, participated in a study evaluating toddlers suspected of ASD. Clinicians assessed participants at a single visit (Mean Age=21.44 months, SD=2.33), 40 received an ASD diagnosis [77.5% male (n=31), 22.5% female (n=9)] and 14 received a language delay (LD) diagnosis [64.3% male (n=9) and 35.7% female (n=5)]. Assessment battery included Communication Symbolic Behavior Scales-Developmental Profile *(CSBS-DP;* social, speech, symbolic composites), Mullen Scales of Early Learning, and ADOS-2. The standardized calibrated severity score (CSS) was generated as a metric of relative severity of ASD symptoms for each ADOS-2. Differences in CSBS-DP composite scores and CSS among the two diagnostic outcome groups were assessed using two-sample t-tests. Age-adjusted tests and gender by diagnosis interactions for each measure were assessed using linear regression and two-way ANOVAs.
Results:
Results revealed significant differences on CSBS-DP composites between the two diagnoses, ASD and LD, with LD toddlers receiving higher scores across all three composites (Speech: p<.001, Social: p<.001, Symbolic: p<.001). ASD toddlers received significantly higher CSS scores than LD toddlers (p<.001). Analyses revealed age-adjusted results as complimentary to the t-tests for all measure outcomes. However, a significant interaction between gender and diagnosis for Symbolic composite was observed (p=0.016), with ASD males receiving higher scores than ASD females and LD females receiving higher scores than LD males. All other interactions between gender and diagnosis were not significant.
Conclusions: The results contrast and differentiate communication skills of ASD and LD toddlers as measured by the CSBS-DP. These findings support the use of the CSBS-DP within a comprehensive ASD evaluation, by capturing verbal and nonverbal communication, highlighting social communication vulnerabilities, and leading SLPs to make informed decisions regarding further evaluation and treatment planning.

152 **142.152** Validity of the SRS in Minimally Verbal Children

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Background: Implicit in any comparison of scores between groups is the assumption that an instrument is measuring the construct in the same way across groups; when this assumption is tested and confirmed, the instrument is said to have the property of measurement invariance (MI). Despite being an essential psychometric property, MI is often overlooked. This property is especially important for a measure of ASD symptoms, given the heterogeneity in presentation of this condition.
Objectives: The goal of this analysis was to test MI of the Social Responsiveness Scale, Second Edition across minimally verbal (MV) and verbal (V) children with ASD. Several items on the SRS-2 relate to verbal abilities, suggesting that scores for MV children should be interpreted with caution. Although considerably information on the concurrent/predictive validity of the SRS exists, neither the Total Score nor the Treatment Subscales of the SRS-2 were empirically derived, giving rise to the possibility that initial model fit may be poor and MI irrelevant. Thus, we first assessed the Total Score and the Treatment Subscales, but followed with evaluation of two empirically derived solutions: the SCI and RRB two-factor solution specified in the SRS-2 manual and the five-factor solution proposed by Frazier et al. (2014).
Methods: Â Data were drawn from the Simons Simplex Collection, comprising children with nonverbal IQ less than 70 and no phrase speech (MV; *n*=298) and children with nonverbal IQ greater than 70 and phrase speech (V; *n*=2,338). Invariance was tested in a multiple group confirmatory factor analytic framework. Model fit, and change in model fit as a result of increasing parameter constraints, was assessed with several complementary statistics (only RMSEA and ΔMcNCI are reported here).
Results: Â Fit statistics are shown in Table 1. Neither the Total Score nor the Treatment Subscale factor models fit the data, with the exception of the Awareness factor, which had adequate fit. Configural and metric invariance were also supported for the Awareness factor, but scalar was not. The fit of both the two-factor model and the Frazier model to the data were adequate; configural and metric invariance were supported, but not scalar.
Conclusions: These analyses demonstrated first that the Total Score and Treatment Subscales generally do not represent unidimensional constructs, and we were unable to produce psychometric support for their use, regardless of language level. Although we did find evidence for the adequate fit of the Awareness Treatment Subscale, mixed evidence for the fit of the two-factor model, and confirmed the adequacy of the Frazier et al. structure, scalar invariance of any organization was not supported across the MV and V subgroups. This means SRS-2 scores reflect both symptom severity and some unmeasured factor that differs between groups; functionally, this suggests that it is inappropriate to use these subscales without accounting for verbal ability, and that scores may not be combined or compared across groups.

153 **142.153** Cultural Differences in Symptom Recognition, Diagnosis, and Time Lag of Autism: A Comparison Between Japan and the US

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Background:
The increase of autism is a global phenomenon, yet little research has examined whether cultural factors contribute to differential timelines for diagnosis of autism. Reasons for later diagnosis do not appear to be solely related to lower socioeconomic status or resources available in each country. Early markers of autism in one culture/country may be considered normal development in another, and may affect the timing of diagnosis (Matson et al. 2011). Cultural beliefs attached to disability can also create barriers to early identification (Saetermoe et al, 2001).
Objectives:
The current study compares factors associated with the first signs, first formal diagnosis, and the time lag between them, in U.S. and Japanese families.
Methods:
These data are from our ongoing cross-cultural research on mothers of children with autism. The study population included US and Japanese mothers of children ages 2-12 who had received a formal diagnosis of autism. Participants completed 5 questionnaires (Parenting Stress Index (PSI), Social Communication Questionnaire (SCQ), Social Responsiveness Scale (SRS-2), Child Behavior Checklist (CBCL), demographic questionnaire) and were interviewed regarding their experience of parenting their child with autism.
Results:
The data from fifty US and 50 Japanese mothers were analyzed. Mean age (months) of the first concern, the first formal diagnosis and the time between the two were earlier for the U.S. sample (18.7, 40.6, and 21.9) than those of the Japanese sample (20.6, 48.4, and 27.8). For both countries, 76% of participants indicated that parents (as opposed to professionals) were the first to recognize abnormalities of the child's behavior and development. Table 1 shows the comparison of the first symptoms to arouse concern between the US and Japan. In the ANOVA analysis, symptoms specific to autism, such as communication difficulties, fixation, and sensory issues, were more often referenced as the first symptom in the US sample compared to the Japanese sample. Interviews indicated the reasons for time lag as (1) long wait time, (2) medical and educational professionals' lack ofÂ knowledge about autism, (3) complex medical system, and (4) availability of intervention programs before formal diagnosis in the U.S ((1)(2) for Japan).
Correlations between early diagnosis and child/parent characteristics (Table 2) revealed that greater autistic characteristics were significantly correlated with earlier formal diagnosis for Japanese children, whereas greater autistic characteristics were significantly correlated with earlier age of first sign for U.S. children. Finally, child problem behavior, especially internalizing behavior, was positively associated with later recognition of child's abnormalities for the Japanese sample. There was no correlation between first sign/diagnosis and child problem behavior for the U.S. sample.
Conclusions:
Our preliminary findings indicate that children with greater autistic symptoms are noticed or diagnosed at earlier ages in both countries. Child behavior problems, especially internalizing behaviors, may delay parents or professionals from noticing abnormalities of development in Japan, but not the US. More research is needed on cultural and child/maternal factors associated with the timing of diagnosis.

154 **142.154** Who Goes Unseen? Race, Socio-Economics, and Autism Screening

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Background:
The American Academy of Pediatrics recommends all children be screened for ASD at 18 and 24 months of age. ASD screening tools allow clinicians to identify children at risk and provide diagnoses at younger ages. However, not all families engage with follow-up or evaluation services after screening. Historically, families of color and families of lower socio-economic status (SES) have lower rates of engagement with ASD services. While universal screening tools remove some barriers to access to intervention, racial and socioeconomic disparities may influence the extent to which screening is effective in population subgroups.
Objectives:
This study presents preliminary data from initial screening at 18-24 months of age, and examines patterns of attrition related to race, maternal education, and income.
Methods:
Participants were drawn from a sample of children who screened positive on the M-CHAT-R/F or the M-CHAT when screened at 18-24 months of age. Parents were invited to complete a follow-up phone interview to determine eligibility for a free diagnostic evaluation and offered an evaluation if appropriate. Participants lost to attrition who did not complete a phone interview for evaluation eligibility are the No Phone Interview (No-PI) group (n=310). Participants who completed a phone interview and were offered an evaluation are divided into two groups: the Evaluated group (n=634) and those lost to attrition before completing the evaluation (No-Evaluation group) (n=75).
Results:
At the 18-24 months screening, groups did not differ by age or gender. Groups differed significantly on years of maternal education, with the mothers in the No-PI group having significantly fewer years of education than mothers in the Evaluated group. There was also a significant difference between groups on median income such that the No-PI group had a lower median income than both the No-Evaluation and Evaluated groups. The groups also differed significantly on race/ethnicity. Those in the No-PI group were more likely to be children of color than children in the Evaluation and the No-Evaluation group. Those in the No-Evaluation group were also more likely to be children of color than children in the Evaluated group.
Conclusions:
This study presents preliminary data on a sample of participants who screened positive on an ASD screening tool but did not complete the follow-up or evaluation compared to peers who competed follow-up and evaluation. Children of color, lower income, and with mothers with less education were less likely to complete the diagnostic process. These data suggest universal screening removes some barriers in the early detection process. However, more minority and lower SES participants than White and higher SES participants were lost to attrition, and thus lost access to evaluations that made them eligible for treatment services. This is a notable pattern of disparate access for pediatricians and early interventionists who serve more vulnerable populations to consider.

155 **142.155** Novel Approaches to Parent-Reporting of Behaviors in Autism Spectrum Disorder

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Background: Current autism spectrum disorder (ASD) interventions are mainly evaluated using retrospective parent-reported measures. While useful for describing general clinical presentation, this methodology often requires recall of specific behaviors weeks after they occurred, which can reduce accuracy of ratings. Furthermore, these measures are typically only administered before and after an intervention, limiting the ability to assess stability or dynamic change during an intervention. Emerging technologies are making it increasingly feasible to administer validated scales repeatedly in a simple and efficient format that can that can both improve parental experience and help enhance the validity and reliability of their reports.
Objectives: Validate MyJAKE - a web and mobile application – that allows parents to complete a new online rating scale (The Autism Behavior Inventory, ABI) about their child. The ABI contains 5 domains: Social Communication, Repetitive Behaviors, Mental Health, Self- Regulation and Challenging Behaviors. In addition, parents report significant behaviors such as affect and sleep and other events as they occur. Comparisons were made between these measures, other scales, and data from biosensors which individuals with ASD wore in the home.
Methods: Parents of individuals with ASD aged six years to adult completed the ABI online alongside commonly used paper-and-pencil scales at regular 4-week intervals during an observational clinical study (n=127). They also used the JAKE app to make daily reports on their child's sleep quality, affect, and other self-selected specific behaviors across an 8-week observational study. Individuals with ASD wore an actigraphy device each night for the duration of the study. Correlations between all parent-reported measures were calculated. Actigraphy sleep features were also compared to parent-reported measures of sleep and other behaviors.
Results: The ABI showed good internal consistency (Cronbach's alpha >0.80 for all 5 domains) and convergent validity with other rating scales: ABI/ABI-Short(S) social communication domain with Social Responsiveness Scale (SRS) social communication domain (r=0.73/0.62); ABI/ABI-S restricted or repetitive behavior (RRB) domain with SRS RRB domain (r=0.76 /0.71). Daily JAKE report measures correlated with scales (average daily report of overall type of day correlated with 4 weekly reports of caregiver burden (r=-0.30 p=0.02 n=88) and with ASD symptoms (r=-0.50 p<0.001); average valence on mood report correlated with daily reports of sleep (r=0.43, p<0.001). Actigraphy recordings correlated with parent measures of sleep and other behaviors: average sleep start time correlated with average daily tracker sleep report (r= -0.23 p=0.04 n=85); average sleep duration correlated with ABI core symptoms (r=-0.44, p<0.01).
Conclusions: The ABI is performing well, showing high internal consistency and moderate-to-high associations with standardized paper-and-pencil measures. Daily measures of behavior also showed statistically significant correlations with the ABI and other scales. The use of daily tracking of symptoms by parents could be a useful way of identifying early change in response to intervention. Sleep features measured by actigraphy showed some correlation with parent reports of sleep and with other parent-reported behaviors, demonstrating potential use of a more objective measure to accompany parental report of change over the course of an intervention.

156 **142.156** Eye-Tracking Features As Diagnostic Markers of Autism Spectrum Disorder, Symptom Severity, and Change over Time

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Background: Research in eye-tracking has indicated that individuals with autism spectrum disorder (ASD) may differ from typically developing (TD) individuals in relation to allocation of attention to social and non-social stimuli. Though not conclusive, there is evidence of reduced attention to faces, eyes, and mouths, and increased attention to bodies and non-social elements in ASD. However, large-scale replication of these results is warranted, as is a deeper exploration of underlying relationships between eye tracking measures and clinically-relevant features of autism as well as applicability of these measures across the lifespan.
Objectives: To examine the discriminant validity (ASD vs TD) of different eye-tracking paradigms including dynamic, naturalistic, and static stimuli reported in literature broadly across development (childhood to adult); and to examine the relationship between ASD symptoms in ASD and performance on eye tracking tasks.
Methods: 127 ASD participants between six years and adulthood (mean [SD] age: 14.6 [7.91]) were monitored for attention to screen and pre-identified regions of interest using the Tobii X2-30 Eyetracker. A range of stimuli was presented, including Dynamic videos (Plesa-Skwerer, Chu, Brukilaachio, & Tager-Flusberg, 2016), Biological Motion, and a Visual Exploration Task. Stimuli were viewed at three time points during the course of the observational study. Parent reports on behavior rating scales were obtained at the same time points (0, 4, 8 weeks). Also, 41 TD individuals between six years and adulthood (mean [SD] age= 16.2 [13.18]) were presented with the same stimuli at baseline (0 weeks) only.
Results: Multiple eye-tracking stimuli discriminated between ASD and TD groups. Statistically significant findings included Biological Motion: Time spent looking at biological motion (n=108/38;[ASD/TD] d= -0.93, p<0.001); Dynamic Videos: Time spent looking at screen overall (n=82/38 d=-0.47; p=0.015),time spent looking at faces (n=82/38d= -0.72; p=0.001); and Visual Exploration Task: ASD participants explored less images per total time while looking at the screen (n=108/41); d= -0.63 p<0.001).
Many features across eye-tracking stimuli also correlated with increased ASD symptomology. Statistically significant findings included: reduced attention to screens during videos (n=52; r= -0.50, p<0.001); reduced attention to object of joint attention (moving toy) (n=81; r=0.34, p<0.001);
Finally, there were statistically significant correlations between change in biosensors from baseline with change in reported symptoms; Dynamic videos; change in attention to faces during the opening segment of videos statistically significantly correlated with change in ASD symptoms between baseline and endpoint (n=41; r= -0.42, p<0.01); visual exploration task; change from baseline in amount of time spent looking at images of high autism interest correlated with change ASD symptoms (n=75, r=0.37 p<0.001).
Conclusions: It was possible to discriminate between ASD and TD groups across a broad developmental range on eye-tracking measures that have previously been reported in the literature. For some of these features, there was also a statistically significant correlation with behavior rating scales. Finally, change in eye-tracking features over time was significantly correlated with reported change in behaviors during the same period. Taken together, these findings demonstrate the potential utility of eye-tracking measures as meaningful biomarkers and sensitive outcomes for use in clinical trials.

157 **142.157** Identifying EEG Biomarkers As Potential Change Indicators in Autism Spectrum Disorder Clinical Studies

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Background: Autism spectrum disorder (ASD) is a neurological condition, thus it is expected that correlates of brain functioning can discriminate between ASD and typically developing (TD) populations, and furthermore these EEG-derived measures may account for variation in core and associated symptoms of ASD. Based on existing research, abnormal hemispherical asymmetry and differences in attentional allocation may be detected using EEG in ASD. Moreover, GABAergic dysfunction may lead to associated changes in related frequency bands. Identification of relationships between EEG correlates of brain activity and reported symptoms can contribute to the development of potential targets and novel outcome measures.
Objectives: Identify differences between TD and ASD in EEG recordings and relation of these measures to symptom severity.
Methods: JAKESense – a set of biosensors and experimental tasks – was administered to individuals with ASD (n=127, mean [SD] age: 14.6 [7.91]) and TD participants (n=41, mean [SD] age: 16.3 [13.18]). EEG was recorded according to 10-20 system during resting state condition (eyes closed or viewing hourglass), social vs non-social videos, and point-light displays of biological vs non-biological motions. Experiments were performed at 9 different geographical locations, ranging from research sites professional with EEG to clinical sites with no prior EEG experience. EEG was recorded simultaneously with eye-tracking, and only data, when participants were looking at stimuli, where considered for analysis. Age and gender was considered as covariates during analysis.
Results: During resting state, significantly ($p<0.05$) smaller alpha power at posterior regions were found in ASD in comparison to TD participants primary during eyes closed condition. Posterior alpha power correlated negatively, while frontal gamma correlated positively with symptom severity (e.g. occipital, eyes closed α vs ABC lethargy social withdrawal r=-0.4, p=0.001, frontal gamma vs SRS total r=0.35, p=0.011). Ratio in power between left and right hemispheres, characterizing functional brain asymmetry, were found significantly ($p<0.05$) smaller in ASD than TD for eyes opened and closed conditions for many brain regions and frequency bands. Coherence between frontal and other regions was significantly ($p<0.05$) higher in delta, theta and alpha and smaller in gamma in ASD than TD. During observation of social videos, suppression in alpha in comparison to non-social videos was significantly more prominent in TD than ASD in frontal, central and temporal regions ($p<0.01$), while no significant difference in theta ratio between two conditions of videos was found. Ratio in frontal alpha between biological and non-biological motion conditions correlated positively with social communication skills (e.g., r=0.23, p=0.073 at Fz)
Conclusions: EEG measures show potential for discriminating between ASD and TD individuals, and correlate with core and associated ASD symptoms. Difficulties obtaining reliable EEG recordings across a number of novice sites suggest that careful training and recording processes are needed, as well as use of stimuli that is engaging and reduces participant discomfort. Such instruction, processes, and stimuli have been established throughout these observational studies to enhance future use of EEG and enable continued understanding of this biosensor's contribution to the development of sensitive outcome measures in ASD.

158 **142.158** Cardiovascular Indices As Outcome Measures in Autism Spectrum Disorder Clinical Trials

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Background: Heart rate (HR) and heart rate variability (HRV) are regulated by the autonomic nervous system (ANS). Several prior studies have reported elevated HR and reduced HRV in individuals with autism spectrum disorder (ASD) in comparison to typically developing (TD) controls and other clinical populations. However, less is known about these cardiovascular indices in response to social and non-social stimuli within ASD, and how they associate with reported symptomology over time.
Objectives: Evaluate HR and HRV between ASD and TD groups at rest, and within individuals with ASD in response to presentation of a range of social and non-social stimuli, including correlation with reported symptomology over time.
Methods: Cardiovascular data was collected using Actiwave Cardio Single-Channel Electrocardiogram while participants (ASD: n=127, mean [SD] age=14.6 [7.91]; TD: n=41, mean [SD] age=16.27 [13.18]) were at rest while observing a range of dynamic and static social and non-social stimuli across three blocks lasting approximately 15 minutes each. Baseline HR was calculated during a resting state task, both eyes open (where participants watched sand flow through an hourglass) and eyes closed. ASD participants repeated the task battery at four and eight weeks during a non-interventional trial. ASD and TD participants were approximately matched for age and gender.
Results: HR and RMSSD (a time-domain measure of HRV) were distributed non-normally (Kolgomorov-Smirnov $p < 0.05$) and analyzed non-parametrically. Data are reported as median [IQR].

At baseline, HR in ASD participants was statistically significantly higher than TD controls for both eyes open [88.38 BPM [79.35-96.23] vs. 73.14 BPM [65.81-84.37]) and eyes closed (89.32 BPM [79.32-97.62] vs 74.18 BPM [65.68-84.72]), both $p < 0.001$). RMSSD in ASD participants was statistically significantly lower than TD controls eyes open (43.43ms [27.41-72.26] vs. 61.28ms [38.41-93.16], p=0.024) and eyes closed (42.17ms [26.95-70.44] vs. 62.13ms [41.66-108.6], p=0.022).
The following findings between baseline assessment and endpoint assessment periods were also observed: HR during the passive viewing of social and non-social dynamic visual stimuli (Kanwisher task) was statistically significantly correlated with the ABI Social Communication subscale (Spearman's rho = -0.23, p=-0.043); RMSSD during the passive viewing of social and non-social dynamic visual stimuli (Tager-Flusberg task) statistically significantly correlated with the SRS Social Communication and Interaction subscale (Spearman's rho =-0.25, p=0.02); and RMSSD during both the Kanwisher and Tager-Flusberg tasks statistically significantly associated with the ABI Restrictive and Repetitive Behavior subscale (rho=0.30, p=0.008; rho=0.30, p=0.009).
Â Conclusions: Results confirm previous findings of statistically significant differences in cardiovascular indices between ASD and TD populations at rest. Changes in these indices between time points also significantly correlated with changes in reported symptom severity, indicating the potential of cardiovascular indices as sensitive outcome measures of clinical trial interventions.

Poster Session
143 - Epidemiology
12:00 PM - 1:40 PM - Golden Gate Ballroom

159 **143.159** ASD Prevalence Study Across Europe: Developing a School-Based Teacher Nomination and Screening Approach

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Background:
In the wake of dramatic increases in ASD prevalence in recent decades, parent organizations are advocating for better services in many national governments across the European Union (EU). It is expected that over the next few years, the increase in political pressure will oblige governments to respond appropriately to this demand. Currently, however, there is no system for measuring ASD prevalence in the EU to provide baseline public health information. An important feature of such a baseline system would be a standardized method applicable across EU sites that would yield comparable prevalence rates across geographic areas.
Objectives:
The main objective of the presentation is to describe the strategy of the Autism Spectrum Disorder in the European Union (ASDEU) project to estimate the prevalence of ASD in school-aged children across Europe. The focus is on the novel field study methods and aims to be a reflexion on what we have learned regarding standardization of study methods across sites, what has worked well and what could be done differently in the future.
Methods:
A cross-sectional field study was implemented in the ASDEU project to ascertain ASD cases in 8 European countries: Austria, Bulgaria, Ireland, Italy, Poland, Portugal, Romania, Spain. The field study is based on a 3-stage screening strategy in primary schools including 1) Teacher Nomination (TN); 2) screening of nominated children using the Social Communication Questionnaire (SCQ); 3) clinical evaluation of SCQ positive children using ADOS and psychometric measures. A target population of 200000 children aged 7-9 years residing within the selected areas during 2016 is expected to be screened (8,000-10,000 per country).
Results:
The main challenges in the cross-sectional field study were common across sites and related to the adjustment of the study timeframe to school calendar years, the harmonization of screening methods to different educational/health systems and country-specific authorization requirements. Piloting of the TN method in schools known to have ASD children indicated that the number and type of issues signalled by teachers for nominated children are different for children with ASD or with other neurodevelopmental problems. A total of over 13,000 school children have already been screened in 5 countries, with 2,035 children (approximately 15%) nominated by teachers. The TN method, after translation and adaptation in 8 countries, was generally well received by teachers. The overall school participation rate was 92.5% in 5 sites, ranging from 42.5% to 100%, indicating that some countries require additional efforts to promote the study in schools. Initial findings regarding SCQ and clinical assessments across sites will be presented.
Conclusions:
ASDEU is the first study to estimate ASD prevalence across European countries using a common methodology. Analysis of early results indicates the field study is feasible and challenges related to cultural and educational systems diversity can be overcome. This method will be compared with population-registry screening approaches in Iceland, Finland, France and Denmark. The final ASD prevalence estimated across Europe will be fundamental to establish an evidence-based, EU-wide response to the growing societal needs of individuals with autism.

160 **143.160** ATN Longitudinal Study: 3-Year Follow-up of 575 Youth with ASD

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Background: Â This abstract introduces the ATN Longitudinal Study, a large-scale effort to describe behavioral, functional, and medical outcomes in children and adolescents with ASD. Comprehensive longitudinal data for youth with ASD are extremely limited, and few large-scale longitudinal cohorts exist. The Autism Speaks Autism Treatment Network (ATN) is a collaboration between Autism Speaks and 14 children's hospitals and medical institutions across North America. The ATN has established an open-access registry of data from almost 7000 youth with ASD, containing diagnostic, behavioral, functional, and medical data, and biospecimens in a limited subset. The ATN Longitudinal Study was designed to collect data 3-4 years after initial enrollment in the ATN Registry in a cohort that is broadly representative of the ATN Registry participants.
Objectives:
To describe the trajectory of behavioral, functional, and medical symptoms of ASD over 3-4 years, and the associations across these symptom domains.
Methods:
Subjects were randomly selected from among those who enrolled in the ATN Registry in 2011-13. These families were re-contacted for follow-up assessment on a battery of measures that were administered at enrollment, including the Vineland-II, CBCL, Aberrant Behavior Checklist, Pediatric Quality of Life scale (PedsQL), Children's Sleep Habits Questionnaire (CSHQ), a standardized medical history form, and limited physical examination. Families who were not able to schedule an in-person assessment were evaluated remotely by phone, internet, and mail. In this first abstract, we report on functional outcomes from the Vineland.
Results:
1275 subjects were contacted, and 575 consented to participate. Consented subjects were 83% male; 81% White, 7% AA, 5% Asian, and 92% non-Hispanic. Age was 5.9 years ± 3.2 (mean ± SD, range 2y0m to 16y10m) at initial assessment, and 9.7 ± 3.2 at follow-up. Consenters and non-consenters showed no differences in race, ethnicity, or sex and had similar baseline scores for ADOS severity, Vineland-II, and frequency of sleep, GI and seizure disorders. Non-consenters scored worse on measures of hyperactivity, on the CSHQ, and had trend worse scores on the PedsQL.
Among 571 participants who completed follow-up Vineland-II assessments, Composite scores showed little change: 71.6 ± 11.6 at baseline, and 70.5 ± 14.6 at follow-up. Domain scores also showed little change in the full cohort. However, while the mean Composite and Domain scores were steady or showed small increases among subjects <6 y.o. at baseline, they tended to decrease among those who were 6-12 y.o. at baseline (Figure 1). Among subjects whose baseline Composite scores were <80, mean scores were steady or increased slightly, but among those whose baseline scores were >=80, scores decreased (Figure 2).
Conclusions:
Mean changes in Vineland score seen among participants in the ATN Longitudinal Study were largely congruent with previous reports in smaller cohorts. Future analyses will examine the relationships between the Vineland and other measures and the association of medical co-morbidities and these outcomes in our ongoing study.

161 **143.161** Age of Earliest Evaluation Among Linguistically Diverse 8-Year-Old Children with Autism Spectrum Disorder, Denver Metropolitan Area, 2010 - 2012

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Background: The prevalence of autism spectrum disorder (ASD) among surveillance sites in the United States is 14.6 per 1,000 8-year-old children. This prevalence varies significantly by race and ethnicity with more white, non-Hispanic children identified with ASD compared with black or Hispanic children. Compounding the understanding of prevalence among different racial and ethnic groups is the role of culture and linguistic diversity (CLD) on healthcare seeking behavior of families of persons with ASD. Children from CLD backgrounds within the US are more likely to be misdiagnosed and often diagnosed later than children who are white.
Objectives: The purpose of this analysis is to understand linguistic diversity among children with ASD in the Denver metropolitan area and understand its role on the age children are evaluated for developmental concerns.
Methods: Data were collected by the Colorado Autism and Developmental Disabilities Monitoring (ADDM) Project as part of the Centers for Disease Control and Prevention's ADDM Network – a population-based surveillance system of ASD among 8-year-old children. Participants are children born in 2002 and 2004 who met the ADDM Network case definition for ASD in the 2010 and 2012 surveillance years, respectively, and resided in Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, or Jefferson counties.Â A child is linguistically diverse if a qualified examiner in a developmental evaluation describes the child as speaking a language other than English, lives in a household where a language other than English is spoken, or was internationally adopted at greater than 12 months of age. A child was determined to be English-speaking only when the qualified examiner did not mention another language other than English in a comprehensive evaluation.
Results: Â The CO ADDM Project identified 820 children who met the ASD case definition during the 2010 and 2012 surveillance years. Among these children 85.6% were English-speaking only and 14.2% were considered linguistically diverse. Two children had an unknown language status. Compared with children who spoke English only, children who were linguistically diverse were first evaluated for developmental concerns at a younger median age (41.5 months compared with 46 months, respectively) and were more likely to have intellectual disability (IQ ≤ 70) (25.9% compared with 17.0%, respectively). When controlling for race, cognitive ability, and maternal education, linguistic diversity does not appear to effect the age at which a child is first evaluated. Rather, having intellectual disability significantly contributes to a child being seen for a developmental evaluation at earlier ages.
Conclusions: Â This analysis presents a deeper understanding of linguistic diversity's role in public health outcomes. Although linguistically diverse children are seen for a developmental evaluation at younger ages compared with English-only speaking children, this difference can be explained by the greater proportion of intellectual disability among linguistically diverse children with ASD in this surveillance dataset. Our findings suggest that linguistically diverse families may be less likely to seek an evaluation for children unless they have cognitive impairment. Further research is needed to better understand healthcare seeking behaviors of diverse families of children with ASD – with and without intellectual disability.

162 **143.162** An Exploratory Study on the Epidemiology of Autism Spectrum Disorder in Nepal

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An Exploratory Study on the Epidemiology of Autism Spectrum Disorder in Nepal

Background: Early markers of Autism Spectrum Disorder (ASD) are present within the first 2 years of life making diagnoses possible by 24 months. Early diagnosis enables access to early intervention, known to promote better developmental outcomes in young children. However, there is limited research regarding the age of diagnosis (AoD) of ASD in low and middle-income countries (LMIC). Moreover, lack of awareness, cultural differences in interpreting ASD symptoms, delayed or alternative modes of help-seeking behaviours, limited access to intervention services and stigma associated with the disorder have led to delayed diagnosis of ASD in LMIC.

Objectives: The average AoD of ASD between 2010 and 2015 in Nepal was examined for males and females. The frequency of children diagnosed with ASD was also studied according to ethnicity, ecological zones, and districts. Finally, any change in AoD across the 6 years of sampling was examined.

Methods: De-identified data of 246 children registered at AutismCare Nepal Society (ACNS) from January 2010 to December 2015 and with a diagnosis of ASD as determined by paediatricians, child psychiatrists, and psychologists, were included in the study. The age of ASD diagnosis (in months) of children, gender, ethnicity and postcodes were extracted. Ethnic codes defined by Health Management Information System, Department of Health Services, Nepal were utilised to classify ethnicity. The postcodes were categorised into the types of ecological regions and districts according to Nepal Central Bureau of Statistics, 2011.

Results: The average AoD in children registered at ACNS between 2010 and 2015 in Nepal was 58 months ranging from 14 to 187 months. The ratio of a 1:3 Male (n-187): Females (n=59) diagnosed with ASD confirmed previous studies. There was no difference in AoD between males and females. The majority of the children (80 %, n=153) were from Upper caste groups. On the contrary, there were only 62 children from relatively advantaged group whereas 31 from a disadvantaged group. There was no significant statistical difference in AoD across three ethnic groups. But, Upper caste groups were diagnosed 7 months earlier than “Relatively Advantaged” and 17 months earlier than “Disadvantaged Group”. In addition, the hill region had the highest number of diagnosed children (n= 211) in contrast to Terai (n=33) and Mountain regions (n=2). In particular, 76 % of the children from the hill region were living in Kathmandu Valley. Finally, there was an increase in the number of children registered at ACNS between 2010 to 2015, with a decreasing trend in the AoD from 2013.

Conclusions: The findings show wide variability in the AoD of children with ASD in Nepal, with a decrease in diagnostic age over time. This decrease from 2013 coincides with the introduction of the DSM-5. The findings also illustrate a significant ethnic inequality and regional disparities in the number of children diagnosed with ASD. In conclusion, there is a great need to reduce the disparity in available services to promote early diagnosis of ASD across the population in Nepal.

163 **143.163** Association Between Breastfeeding and Autism Spectrum Disorder in Preschool Children: An Analysis of Data from the Study to Explore Early Development (SEED)

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Background: Most causes of autism spectrum disorder (ASD) are not well understood. The potential effect of breastfeeding is of interest because breastmilk provides key nutrients for physical and cognitive development of the child, and breastfeeding contributes to maternal-child bonding. However, breastmilk may also contain environmental pollutants or other substances with potential negative effects on cognitive development. Conflicting results have been reported in past studies on the relationship between breastfeeding and ASD, and few studies have examined a possible association with its duration. Methodological limitations noted in past studies include small samples, use of parental report to document ASD diagnosis, lack of a comparison group, and incomplete adjustment for confounding factors.

Objectives: To evaluate possible associations between ASD and (1) breastfeeding and (2) breastfeeding duration, and to identify factors associated with breastfeeding and its duration in cases and typically-developing controls.

Methods: We used data from the Study to Explore Early Development (SEED), a multi-site case-control study that includes children aged 2-5 years ascertained through birth certificates (controls) and clinical and educational sources providing services to children with developmental disabilities (cases). Enrolled children underwent an extensive assessment by expert clinicians using standardized instruments. The diagnosis of ASD was based on the Autism Diagnostic Observation Schedule and the Autism Diagnostic Interview-Revised. Mothers participated in a telephone interview about their pregnancy, including whether the child was ever breastfed and if “yes,” then how old the child was when breastfeeding stopped. We compared cases and controls using logistic regression to assess any association with breastfeeding and multinomial logistic regression to compare child age (tertiles) at breastfeeding cessation. These analyses were adjusted for a variety of child and maternal characteristics.

Results: The sample included 707 cases and 1223 controls. Overall, 75% of children were “ever breastfed.” The mean child age (in months) at breastfeeding cessation was 7.3 in cases and 9.2 in controls. There was no independent association between breastfeeding and ASD (adjusted odds ratio [aOR]: 0.92 (95 CI: 0.65, 1.30). Compared to controls, cases were younger at the time of breastfeeding cessation: aOR comparing highest age tertile (> 12 months) to lowest age tertile (<=3 months) in cases versus controls was 0.60 (95%CI 0.42, 0.87). In both cases and controls, higher maternal education attainment was associated with breastfeeding and its longer duration. In cases, higher family income and having a mother born outside of the United States were each associated with breastfeeding, and older maternal age was associated with longer breastfeeding duration. In controls, white race was associated with breastfeeding and longer breastfeeding duration; cesarean birth, mother with a psychiatric condition, and lower family income were each associated with shorter breastfeeding duration (p-values <0.05).

Conclusions: Although initiation of breastfeeding was not significantly different between groups, its duration was shorter among ASD cases compared to controls. These results document the importance of assessing duration of breastfeeding rather than initiation alone. Multiple factors were associated with both the initiation and duration of breastfeeding, and should be taken in account when assessing the relationship between breastfeeding and ASD.

164 **143.164** Association Between Maternal Pre-Pregnancy Body Mass Index, Gestational Weight Gain and the Risk of Autism in Han Chinese Population

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Background: Autism is a neurodevelopment disorder with unclear etiology. Some previous studies suggested that maternal pre-pregnancy body mass index (BMI) and gestational weight gain (GWG) might involve in the etiology of autism. However, the studies are still limited, and the findings need further replications. Furthermore, there are obvious ethnic disparities in BMI and GWG for the different genetic backgrounds, living environments and lifestyle. So it is necessary to validate in populations from different backgrounds.
Objectives: The goal of this study is to explore the association between maternal pre-pregnancy BMI, GWG and the risk of autism in Han Chinese population.
Methods: 697 Han Chinese autistic children(599 male and 98 female,mean age 4.97±1.19 years) and their parents were recruited through a face to face interview,2200 age-matched unrelated typically developing (TD) children(1187 male and 1013 female,mean age 5.17±1.82 years) were recruited by using a web-based survey.
After removing the outliers, Student's t-test and Chi square test were adapted to compare the demographic characteristics, the maternal BMI and GWG between case and control groups. Then we conducted binary logistic regressions to calculate the Odds Ratio (OR) for the relationship between pre-pregnancy BMI, GWG and the occurrence of autism.
All mothers of the enrolled children were classified as underweight, normal weight, overweight and obese according to the adult BMI classification standards for Chinese population. According to Chinese GWG recommendation, they were classified into inadequate weight gain, adequate weight gain and excessive weight gain based on their GWG.
Results: Â The mean BMI of mothers with TD children was 20.30±2.27, and the mean BMI of mothers with autistic children was 20.50±2.25. The mean GWG of mothers with TD children was 15.04±5.81 kg , while 15.70±6.21kg of mothers with autism. There was a significant group difference in GWG (t=-2.526, p=0.012) and a minor but significant difference in maternal pre-pregnancy BMI (t=-2.015, p=0.044).
The results of logistic regression analyses showed that excessive weight gain during pregnancy was associated with autism risk in the whole samples (OR=1.475, 95%CI: 1.107-1.965) after controlling for the cofoundings. However, the inadequate gestational weight gain was not significantly associated with autism risk (OR=0.875, 95%CI: 0.690-1.110). One the other hand, the relationship between maternal pre-pregnancy BMI and autism was not found to be significant (normal weight was set as reference, underweight group: OR=0.901, 95%CI: 0.679-1.195; overweight group: OR=0.680, 95%CI: 0.445-1.038).
We further analyses the interaction between pre-pregnancy BMI and GWG by adapting stratification analyses with logistic model. And the results showed that neither inadequate (OR=1.225, 95%CI: 0.716-2.097) nor excessive GWG was significantly associated with autism risk for lean mothers. Excessive GWG would increase the risk of autism (OR=1.479, 95%CI: 1.059-2.066) for the normal pre-pregnancy weight mothers, might also significantly but more obviously increase the risk of autism (OR=2.479, 95%CI: 1.059-2.066) for overweight mothers.
Conclusions: To our knowledge, this is the largest scale study in Chinese Han population. Our present study reported that maternal pre-pregnancy BMI might not be associated with autism risk, but excessive GWG might increase offspring autism risk among normal weight and overweight mothers

165 **143.165** Associations of Autism Spectrum Disorder with Residential Air Pollution Exposure in a Large Southern California Pregnancy Cohort

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Background: Â Autism spectrum disorder (ASD) prevalence has increased over several decades to its currently estimated 1 in 68 children in the United States. Recent research suggests that adverse child neurodevelopmental outcomes, including ASD, may occur in association with regional and near-roadway air pollution exposures. There have been limited longitudinal analyses of population-based cohort studies that have addressed the relationship between air pollution and ASD, and results from previous case-control studies have not been consistent.
Objectives: Â This retrospective cohort study evaluated the associations of ASD risk with prenatal exposure to regional air pollutants, including particulate matter (PM) ≤2.5 µm in aerodynamic diameter ($PM_{2.5}$), ≤10 µm (PM_{10}), nitrogen dioxide (NO_2), and ozone (O_3).
Methods: Â We retrospectively identified a cohort of children born in Kaiser Permanente Southern California (KPSC) hospitals between 1995 and 2009 (n=294,637), reviewing electronic medical records from birth until the first date of clinical diagnosis of ASD, last date of continuous KPSC health plan membership, death from any cause, or age 5. Birth certificate addresses were geocoded and used as the residential locations where birth-year annual average exposure to regional particulate and gaseous air pollutants ($PM_{2.5}$, PM_{10}, NO_2, and O3) were estimated by inverse distance weighting to the network of Southern California monitoring stations, and distances to major roadways and freeways were calculated for 294,637 mother-child pairs. ASD diagnosis was defined based on ICD-9 diagnostic codes from at least 2 separate KPSC hospital visits. Relative risks of ASD were estimated by hazard ratios (HRs) using Cox regression models adjusted for potential confounders.
Results: There were 2414 children with a diagnosis of ASD by age 5. After adjusting birth year, for maternal age, parity, education, household income, race/ethnicity, history of comorbidities (≥1 diagnosis of heart, lung, kidney, or liver disease; cancer), sex of the child, and KPSC medical center service areas, HRs scaled to interquartile range of the distribution of each pollutant were 1.18 (95% confidence interval [CI], 1.05-1.34) per 8.74 µg/m^3 $PM_{2.5}$ 1.10 (95% CI, 1.00-1.21) per 11.3 µg/m^3 PM_{10}; 0.95 (95% CI, 0.85-1.07) per 11.9 ppb NO_2; and 0.79 (95% CI, 0.71-0.88) per 10.8 ppb O_3. No associations of residential distance to major roadways and freeways were observed. HRs for air pollutants did not change substantially after additionally adjusting for preeclampsia, maternal diabetes, and preterm birth.
Conclusions: Â Prenatal exposure to $PM_{2.5}$ and PM_{10}, were associated with risk of ASD in children from a large, prospectively analyzed birth cohort in Southern California. Inverse associations with O_3 merit further investigation.

166 **143.166** Autism Features and Gender-Specific Eating Behaviour Problems throughout Childhood: The Generation R Study

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Background: The odds of having eating problems is five time higher for children with autism compared to children without autism [1] and can create medical problems like gastrointestinal dysfunction [2, 3] which is a serious concern for parents [4]. Restricted interests [5], over-sensory and -responsivity to taste, texture and smell of foods [6] may underlie these eating problems. A recent general population study [7] suggests that picky eating is more common in children with autism features. However, it is unknown whether autism features relate to broader eating behaviour problems in the general population.
Objectives: To examine the relationship between autism features and eating behaviour throughout chilhood in a general population sample.
Methods: In this subset (N=3066) of the Generation R study [8] we assessed autism features by the Child Behavior Checklist (CBCL) at age 3 and the Social Responsiveness Scale (SRS) at age 6. Parental report of eating behavior was assembled at age 4 by the Child Eating Behavior Questionnaire (CEBQ) and at age 9 with the CEBQ and one scale of the Dutch Eating Behavior Questionnaire (DEBQ).
Results: Per each 1-point increase in autism features at age 3 (CBCL), children scored 0.06 points higher on Emotional Undereating (95%CI: 0.04; 0.08), 0.05 points higher on Food Fussiness (95%CI: 0.03; 0.08), 0.03 points higher on Slow Eating (95%CI: 0.01; 0.05), 0.04 points higher on Emotional Overeating (95%CI: 0.02; 0.06) and 0.02 points lower on Enjoyment of Food (95%CI: -0.04;-0.00) at age 4 in adjusted models. No gender differences were found.
Children scored per 1-point increase in autism features at age 3 years (CBCL), 0.04 points higher on Emotional Undereating (95%CI: 0.01; 0.06) and 0.03 points higher on Emotional Overeating (95%CI: 0.01; 0.05) at 9 years in adjusted models. In girls, autism features related with increased Emotional Overeating at age 9 years, in contrast to boys.
Each 1-point increase in autism features at age 6 years (SRS), associated with a 0.23 points higher score on Emotional Undereating (95%CI: 0.03; 0.43), 0.30 points higher on Emotional Overeating (95%CI: 0.11; 0.50), 0.29 points lower on Enjoyment of Food (95%CI: -0.47; -0.10), and 0.48 points higher on Food Responsiveness (95%CI: 0.29; 0.76) at age 9 in adjusted models. Whereas in girls, autism features associated with increased Emotional Undereating, Emotional Overeating and reduced Enjoyment of Food, this relation was absent in boys.
Conclusions: This study indicates that autism features in the general population are associated with eating behavior problems throughout childhood, thus not only in clinical populations. Early childhood autism features may predispose eating behavior difficulties, especially in girls.

167 **143.167** Autism Risk Associated with Parents' Age and Educational Status?

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Background: Advanced parental age has attracted attention as a potential risk factor for Autism spectrum disorder (ASD), since the beginning of this trend of delayed reproduction. Studies have reported increased risk of ASD when both parents are of older ages, when there are older fathers but not older mothers and vice versa, or neither. According to National Portugal Statistic, mean age of mother at birth, in 2010, was 28.6 years, reflecting a two years delay in motherhood compared to 2000. In 2014, it stood in 31.5 years. Increased prevalence of ASD is a phenomenon without complete explanation. Examining effects of interactions of parental age on ASD risk is important and if it represents independent risk factors. Moreover, the association between parental educational status and ASD is poorly understood.
Objectives: To characterize the role of advanced parental age at birth in ASD comparing with a group of other neurodevelopmental disorders (OND) without ASD.
Methods: *Participants*included 1973 children and adolescents, ranging in age from 2 to 18 years old. They were divided into two clinical main groups: ASD (N=1202; Male/Female ratio – 5/1) versus OND (N=771; Male/Female ratio – 2.5/1). Participants were seen as part of an outpatient clinic in a tertiary Pediatric Hospital between 1995 and 2015. To be included, all participants had to have registered both parental date of birth; ASD was diagnosed according to positive score for both ADI-R and ADOS, and fulfilment of DSM-5 criteria. Parents of OND group completed the Social Communication Questionnaire to exclude comorbidity with ASD. Parental age was categorized into: < 25; 25 – 29; 30 – 34 and ≥ 35 years of age. To enhance comparability covariates were included: gender; parental educational status categorized according to International Standard Classification of Education – ISCED; birth order; gestational age; Apgar score and pregnancy complications. All statistical computations were performed resorting to IBM SPSS Statistics version 23. We considered the significance level (α) = 0.05
Results: Mean age of mothers at the time of birth was 30.8 ± 5.2 years for ASD and 29.8 ± 5.7 for OND. Mean age of fathers was 33.2 ± 6.0 and 32.7 ± 6.4 years among ASD and OND group, respectively. Significant differences were found between maternal ages of children with ASD and children with OND, $t(1533.486)= -3.927$, $p<0.001$ but not between the corresponding paternal ages, $t(1562.170)= -1.840$, $p=0.066$.
In addition, a significant difference between the two groups was found for parental education (Mann-WhitneyU, $p<0.001$) for ASD group, median parental education was level 3 and for OND group was level 2. In ASD subjects 75% of all fathers and mothers had a level of education equal or less than 4 and 6, respectively; in OND group 75% of all fathers and mothers obtained lowest level of educational (level 3).
Conclusions: In a large sample comparing parental age and educational level of ASD *versus* OND population we can state that older maternal age at birth and higher parental education was independently associated with increased odds of ASD than other neurodevelopmental disorders.

168 **143.168** Autism Spectrum Disorder (ASD) in Qatar:Profiles and Correlates of a Large Clinical Sample

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Background: There is a paucity of studies on ASD in Qatar, mostly in the form of case reports and genetic causes. To date, no studies have explored the characteristics, environmental and genetic factors in the ASD population in Qatar.The current study was designed to describe the clinical characteristic of ASD and its correlates in Qatar.
Objectives: Â The aim of the current study was to describe cases within one of the country's largest special needs centers, the Shafallah Center for Children with Special Needs. The current study evaluated clinical profiles of ASD and their correlates.
Methods: The methodology of the current study was designed to review cases of ASD within Shafallah Center for Individuals with Special Needs between the years of 2011-2015.A total of 171 cases of ASD were identified,Â The analysis included the following factors; nationality, age, gender, socio-economic status, consanguinity, prenatal/postnatal complications, and comorbidities. Â
Results:
80% of the identified cases were males, with a 4:1 male to female ratio. Additionally, 83% of the families had one proband, 9.9% had 2 probands, and 7.1% more than two. Comorbid conditions included; Intellectual Disabilities (ID) in 83% and Epilepsy in 18.8%. 76.6% of subjects were non-verbal. There were 3 (1.8%) children with Rett's Syndrome, 3 (1.8%) with Fragile X, and 1 (0.6%) with Tuberous Sclerosis. The effect of consanguinity as a risk factor was not found to be significant as only 40% of the participant's parents were consanguineous compared to 54% consanguinity rate among general population in Qatar.
Conclusions: In conclusion, the current study is the first attempt at the clinical characterization of ASD in Qatar. This study provides insights to the similarities and discrepancies to what has been noted in other parts of the world and supports the need for a prospective epidemiological study in this population, such a study might contribute to expanding our knowledge of ASD.

169 **143.169** Autism Spectrum Disorder: Mortality and Healthcare Implications from the National Mortality Files

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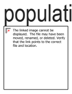
Background:
Autism spectrum disorder (ASD) is a pervasive developmental disorder that globally impacts functioning, and its prevalence is increasing among children (Bukstein & Cornelius, 2006; Baxter et al., 2015). The prevalence of ASD in adults is also increasing as these diagnosed children grow up, yet there is limited information on ASD beyond childhood. The limited literature suggests a poor prognosis for adults with ASD, citing high levels of disability, poor health, low likelihood of independent functioning, and increased mortality risk (Modre et al., 2012). Previous large cohort studies on mortality risk for ASD adults have been largely focused outside of the United States, and more research is needed to determine specific causes of early mortality risk in the ASD population (Hirvikoski et al., 2016). Quantifying frequently occurring, potentially preventable causes of death in the ASD population is imperative to increasing awareness for families, care-takers, policy-makers, and practitioners.
Objectives:
The purpose of this presentation is to describe underlying causes of death for ASD individuals compared to individuals with intellectual disability (ID) and to the general population. A secondary purpose is to quantify mortality rates by age, race/ethnicity, and gender to identify vulnerable sub-populations.
Methods:
This study used national Multiple Cause-of-Death Mortality Data for years 2011-2013. These data sets are created using information from death certificates provided to the National Vital Statistics System (NVSS). The International Classification of Diseases, Tenth Revision (ICD-10) was used to code underlying causes of death. The multiple cause of death codes are classified by NVSS to identify the underlying cause of death from up to 20 multiple causes of death listed. Using ICD-10 codes, individuals with ASD and ID were identified, and cross-tabulations were run to: (1) compare ASD deaths to the ID and typical populations, and (2) compare mortality rates among sub-populations of the ASD group.
Results:
Preliminary analyses of 2011 mortality files, presented in Tables 1 and 2 attached, show 3.3% of deaths in the typical population occur before age 30, compared with 41.1% in the ASD population and 7.8% in the ID population. For the typical under 30 population, 15.5% of deaths are due to non-motor vehicle accidents, compared with 24.5% for ASD, and 2.7% ID. The ASD population under 30 also has a greater proportion of deaths (15.1%) due to ischemic or other heart disease than the typical (4.0%) or ID (1.7%) populations.
Conclusions:
Describing causes of death for the ASD population is a crucial first step in eliminating premature mortality for this group. Results show that deaths in the ASD population are to a disproportionate number of young people under age 30, which could be a reflection of the lower prevalence of ASD among older cohorts. Further, ASD individuals appear to be at increased risk of early mortality due to non-motor vehicle accidents and ischemic heart disease compared with the typical and ID populations. Analyses of the 2011 mortality files are complete, and these analyses will be replicated for 2012 and 2013 in order to substantiate these findings.



170 **143.170** Autism Symptom Severity in Males and Females: An Exploration of Gender Differences Using Item Response Theory

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Background:
Studies examining the role of gender in autism have found inconsistent support for phenotypic differences between boys and girls. However, few studies have systematically tested gender differences in autism symptomatology using gold-standard measures in large samples.
Objectives:
This study aimed to systematically explore gender differences in the phenotype of ASD in a large sample of clinic- or research-referred youth and adults (N = 9697). Specifically, the present study explored symptom bias, mean and variance differences, and the potential moderating role of nonverbal IQ for each of the four ADOS modules.
Methods:
Participants included cross-sectional data compiled from the National Database for Autism Research, Autism Genetic Resource Exchange, and Simons Simplex Collection. Multigroup unidimensional confirmatory factor models were fit to each ADOS module using revised scoring algorithm items to determine differences in factor means and variances between males and females. Fitted models included Module 1 no words (N = 1496) and some words (N = 1792), Module 2 less than age 5 (N = 1076) and greater than or equal to age 5 (N = 1162), Module 3 (N = 3170) and Module 4 (N = 1001). Items were then evaluated for significant item bias by gender using differential item functioning. Finally, to test whether gender differences are moderated by nonverbal IQ, each unidimensional model was estimated including gender, NVIQ, and their interaction as latent predictors.
Results:
None of the items currently included in the ADOS scoring algorithm showed significant DIF (wABC > .35) by gender. Only Module 2 less than 5 years (z = 19.1, p < .001) and Module 4 (z = 9.22, p < .001) showed significant differences between males and females on factor means, such that males scored significantly higher than females. In addition, only Module 2 less than 5 years (σ_{female} = 1, σ_{Male} = .18) and Module 4 (σ_{female} = 1, σ_{Male} = .4) showed pronounced differences in factor variability. Finally, the interaction between gender and nonverbal IQ significantly predicted ADOS severity for all Modules (β_{range}=-0.006 to – 0.002, p < .01) excluding Module 2 greater than or equal to age 5 (β = -0.001, p= .24).
Conclusions:
Males and females who have the same autism severity are nearly equally likely to receive a particular score on a specific item of each module and show similar autism severity and variability in severity. While males scored significantly higher than females when assessed using Module 2 less than 5 years and Module 4, there were also the fewest number of individuals in these groups which highlights the importance of investigating symptom and phenotypic differences in large samples and thus these two populations should be further explored. Finally, although NVIQ impacted ADOS scores for males more so than females, parameter estimates were so small that these results are not likely substantively meaningful. In the absence of phenotypic differences, factors aside from ASD core features, such as associated features and comorbid disorders, must be explored to develop a better understanding of the disparity in prevalence.

171 **143.171** Comparison of Parental Concerns Around Child's Food Intake Between Children with ASD and Typically Developing Children

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Background: Â Background: Food selectivity is a common feeding problem in children with autism spectrum disorder (ASD). In previous reports from our Children's Activity and Mealtimes Patterns (CHAMPS) study we found that children with ASD exhibit more food selectivity and mealtime behavior problems than typically developing (TD) children. Despite the high prevalence of feeding problems among children with ASD, there are few reports about the extent to which parents are concerned about the quality of their child's diet.
Objectives: Â To determine parental concern around eating and diet among children with ASD and TD children.
Methods: Â 53 children with ASD and 58 TD children between the ages of 3-11 years participated in the CHAMPS study. Parents completed several questionnaires including the Meals In Our Household Questionnaire, which we used to assess parental concern about their child's nutritional intake. We focused on 8 questions related to diet quality. We dichotomized the 6-tiered response categories into 2 groups as follows: not concerned, a little concerned and somewhat concerned comprised one category ('Not Concerned') and the responses of quite concerned, very concerned and extremely concerned comprised the other category ('Concerned'). Chi square analyses were used to compare the frequency of parental responses between children with ASD and TD children.
Results: Â We found that parents of children with ASD were significantly more likely to be concerned than parents of TD children that their child was not eating enough (15% vs 2% p<0.013); eating too much junk food (26% vs 7% p<0.005); eating only a few types of food (57% vs 10% p<0.001); not eating enough vegetables (43% vs 10% p<0.001); and not eating enough fruit (32% vs 2% p<0.001). No significant differences were found in response to questions about eating too much (11%vs 3% p<0.15; eating too much fat (13% vs 7%, p<.27) and eating too much sugar (9% vs 5%, p<.48). We did not observe any significant changes in the findings when these analyses were repeated using logistic regression that adjusted for age and sex.
Conclusions: Â These findings suggest that parents of children with ASD have elevated concerns compared to parents of TD children regarding their children's nutritional status. The findings also support the need for professionals to include inquiries about these concerns when working with parents of children with ASD and to develop and test strategies for parents to promote their children's healthy eating.

172 **143.172** Congenital Abnormalities of the Male Reproductive System and Risk of ASD

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Background:
Autism spectrum disorder (ASD) is a developmental disorder with increasing prevalence reported worldwide. While the specific mechanisms driving ASD pathogenesis remain largely unknown, accumulating evidence suggests that androgens have extensive influence on structural and functional brain development in regions that are relevant for ASD, and that atypical in-utero androgens levels or actions is a potential risk factor for ASD. Direct evidence, however, remains scarce, owing in part to the difficulty of obtaining direct measurements of fetal androgens levels during pregnancy. Hypospadias (abnormal positioning of the urethral opening) and cryptorchidism (undescended testis) are two of the most common birth defects in newborn boys, are strongly associated with deficiencies in prenatal androgens, and are readily recognizable at birth. Thus, having cryptorchidism or hypospadias is a proxy indicator of atypical androgen actions during pregnancy, but the association between these two disorders and ASD has not been extensively studied on an individual level.
Objectives:
To evaluate whether male newborns diagnosed with either hypospadias or cryptorchidism at birth were at a higher risk of receiving ASD diagnosis later in life, compared with children born without these conditions.
Methods:
We analyzed all male singleton live births (n=147,324) from January 1, 1999 through December 31, 2008 occurring in a large Israeli healthcare organization. Boys with cryptorchidism (n=3,650) or hypospadias (n=2,343) were identified via ICD-9 codes. ASD cases (n=1,329) were identified by ICD-9 code and verified by review of medical records. Analyses were conducted using logistic mixed effect models with random component accounting for family clusters, and adjusted for covariates.
Results:
In multivariable-adjusted analyses, the odds ratio (OR) for ASD among boys with hypospadias or cryptorchidism was 1.31 (95% confidence interval (CI): 1.03-1.65). For cryptorchidism only the OR was 1.39 (95% CI: 1.04-1.86) and for hypospadias only was 1.16 (95% CI: 0.79-1.71). Restricting to boys who underwent surgical correction strengthened the results for cryptorchidism (OR: 1.63, 95% C.I 1.08-2.45), but not hypospadias.
Conclusions:
Boys with cryptorchidism were at higher risk of ASD, but we did not observe an increased risk among boys with hypospadias. Differences in ASD risk between the disorders may reflect variations in critical windows of exposure to a hypoandrogenic in-utero environment, or effects of other signaling systems involved in the etiology of the disorders. Understanding the links between cryptorchidism and ASD could shed light on mechanisms of ASD pathogenesis.

173 **143.173** Enrollment and Participant Characteristics of SPARK, a National, Web-Based Cohort of Individuals with ASD and Their Family Members

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Background: The heterogeneity of autism spectrum disorders (ASD) and the burden of large-scale phenotyping and genotyping [2] have historically been significant obstacles to the study of this group of neurodevelopmental disorders. Initiatives such as the Interactive Autism Network's (IAN) pioneered efforts in creating large web-based autism registries and have successfully demonstrated the validity of parent-reported ASD diagnosis [3] and the phenotypic data provided [1]. To date, however, no studies of this scale have combined large scale parent-reported data with genetic data to rapidly advance ASD research.
Objectives: The aim of the current study is to describe SPARK and to summarize preliminary demographic and clinical characteristics of SPARK participants <18 years.
Methods: Â Enrollment in SPARK occurs entirely online at SPARKforAutism.org. Participants are asked to indicate their ASD status and relationship to the individual in the family with ASD and to enter basic demographic information. After consenting to share medical, and optional genetic data, participants are then asked to provide the following additional information on the individual(s) with ASD: ASD diagnosis type, age at diagnosis, individual who diagnosed ASD, language ability, ever/never ASD-related services used, ever/never individualized educational plan for ASD, and ever/never intellectual disability diagnosis. Data collected through SPARKforAutism.org also includes a brief medical history and the Social Communication Questionnaire – Lifetime (SCQ) for children age 2 – 18 years. Participants who consent to share genetic data are then asked to provide a shipping address for saliva collection and are also given the option of inviting the other biological family members to participate.
Results: From the launch of SPARK's pilot in December 22, 2015 through October 13, 2016, a total of 8,650 children with ASD enrolled in SPARK. Among child participants, the mean age at enrollment was 8.6 years (SD 4.1), and 80% were male. Mean age at diagnosis was 49.5 months (SD 30.8), and the most commonly assigned diagnosis was ASD (68%). Children were most commonly diagnosed by a clinical psychologist (24%), and the most common language level was use of longer sentences (57%). The majority of parents reported that children received ASD services (89%) and had an IEP (83%). 17% of participants received a diagnosis of ID, and the mean SCQ score was 22.5 (7.1 SD).
Conclusions: Initial enrollment supports the feasibility of implementing a large-scale, web-based registry for ASD that collects both phenotypic and genetic information. Characteristics of the participants <18 years recruited to SPARK are consistent with those described in both CDC's Autism and Developmental Disabilities Monitoring Network study cohorts and IAN samples. Future research on the SPARK cohort will provide more in-depth examination of adults with ASD, evaluate the effectiveness of saliva collection for DNA analysis and examine the associated genetic findings.

174 **143.174** Familial Confounding of the Association Between Maternal Smoking in Pregnancy and Autism in Offspring

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Background: Maternal smoking in pregnancy is a preventable but common exposure thought to lead to neurodevelopmental problems in offspring such as attention deficit hyperactivity disorder (ADHD). Epidemiological studies have evaluated its role in autism with inconsistent findings. Resolving links between maternal smoking and autism is especially difficult because of strong confounding by social class and genetic factors that influence smoking behavior and autism occurrence.
Objectives: To examine whether maternal smoking in pregnancy increases the risk of autism spectrum disorder (ASD), with a focus on disentangling individual and familial effects to account for confounding.
Methods: The study cohort comprised all children born in Denmark in 1991 through 2012 with complete parent and maternal smoking information. The cohort (1,294,906 persons, including 993,301 siblings nested within 728,271 families) was followed from 1 year of age until an ASD diagnosis (13,547), death, emigration, or December 31, 2012. Diagnoses of ASD and the presence of co-occurring ADHD (3319 ASD+ADHD and 10,228 ASD-ADHD) were based on ICD-8 and ICD-10 codes from psychiatric and patient register databases. Maternal smoking data were obtained from the birth register as reported by the mother to her midwife at the first prenatal care visit.Â We estimated adjusted hazard ratios (aHR) and 95% confidence intervals (95% CI) between any maternal smoking and ASD using Cox survival models and robust standard errors to account for familial clustering, adjusting for child sex, parity, parental age, education, income, psychiatric case history, and calendar year. To separate familial from individual effects, we constructed similar models that included a term for the mean level of maternal smoking in the family and the individual's deviance from the family mean (maternal propensity model). A third modeling approach stratified on maternal siblings and considered siblings discordant for maternal smoking in pregnancy to account for unmeasured confounding at the family level.
Results: In the cohort, 21.5% of individuals had a report of maternal smoking in pregnancy. In standard adjusted models, the risk for ASD was slightly elevated for maternal smoking: aHR 1.17 (95% 1.13-1.22). The risk for ASD from smoking was attenuated, however, based on either the maternal propensity model, aHR 0.98 (95% CI 0.88-1.09) or the discordant sibling analysis, aHR 0.86 (95% CI 0.64-1.15). In standard adjusted models of case subgroups, the risk for ASD+ADHD from smoking was higher: aHR 1.54 (95% CI 1.40-1.68) than for ASD-ADHD: aHR 1.09 (95% CI 1.03-1.16), and both were attenuated in the maternal propensity model: ASD+ADHD aHR 1.15 (95% CI, 0.89-1.40) and ASD-ADHD aHR 0.93 (95% CI, 0.82-1.06).
Conclusions: An association between maternal smoking in pregnancy and ASD diagnosis was observed after adjusting for a range of confounding variables, but was attenuated following designs that more fully accounted for unmeasured factors at the family-level, with similar effects observed for ASD with and without co-occurring ADHD. These results suggest that maternal smoking in pregnancy is not a risk factor for ASD and that elevated associations reported in previous studies may arise in part from not fully accounting for confounding influences at the family level.

175 **143.175** Geographic Differences Among Children with Autism Spectrum Disorders

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Background: There have been few nationally representative surveys that have explored geographic differences among children with autism spectrum disorder (ASD). Yet, regional differences may provide insight into what factors influence the likelihood that a child is diagnosed with ASD and whether the child is able to receive necessary services and treatments. In fact, previous studies have found varying rates of unmet needs and service utilization by geographic region (Chiri & Warfield, 2012; Lokhandwala, Khanna, & West-Strum, 2012). The current study expands the limited literature by analyzing regional differences in ASD prevalence and service utilization within a nationally representative sample of children.
Objectives: 1) Calculate the prevalence of ASD in four geographic regions (Northeast, Midwest, South, West), 2) Explore child and household demographic characteristics and the service utilization of children with ASD in each of these four geographic regions.
Methods: Data were drawn from the 2014-2015 National Health Interview Survey (NHIS). NHIS is a nationally representative household survey of the noninstitutionalized US population. Respondents (usually parents) provided information on receipt of an ASD diagnosis and service utilization (among other topics) for one randomly selected child in each family. Children aged 3-17 years were included in this analysis.
Prevalence estimates were calculated using Stata 13.1 SE, which accounted for the complex survey design of the NHIS. Differences between geographic regions were compared using logistic and linear regressions with and without adjustment for child and household characteristics.
Results: The prevalence of ASD was highest in the Northeast (3.14%), followed by the Midwest (2.57%), South (2.15%) and West (1.86%). Without adjustment, children in the Northeast were significantly more likely to be diagnosed with ASD than children in the South and West. After adjusting for child and household demographics, children in the Northeast remained significantly more likely to be diagnosed with ASD than children in the West, but not the South.
Children with ASD living in the Northeast were the most likely to live in households with an annual income 400% or higher than the federal poverty level and live in two parent households. The majority of children with ASD in the Northeast lived in a large metropolitan statistical area (69.4%) and were non-Hispanic white (70.5%). Children with ASD located in the Northeast were younger than children with ASD in the Midwest.
Overall, the frequency of service utilization (number of office visits, ER visits, home visits) was highest among children with ASD in the Northeast, but this difference was not significant after adjusting for child and household demographics. However, even after adjustment, children with ASD in the Northeast were significantly more likely to have seen a specialist, therapist, or mental health professional in the past twelve months.
Conclusions: There were notable demographic differences among children with ASD between regions. These differences accounted for observed differences in the frequency of service use, but regional differences in specialized service use remained significant.

176 **143.176** Improving the Identification of ASD Cases from Claims Data Using Machine Learning and Latent Class Analysis

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Background: Current methods for identifying ASD cases in electronic medical records, particularly when restricted to claims data and without access to notes or laboratory results, rely on the presence of specific diagnostic codes (299 and its children for ICD-9-CM). Claims datasets are a potential source of data for establishing studies with large sample sizes, but ICD-9-CM diagnoses are prone to error and are limited in their sensitivity and specificity when compared to gold standard diagnostic measures. However, the considerable co-morbidity in ASD may allow the utilization of other, non-ASD diagnoses to improve identification of potential ASD cases in claims datasets, in addition to distinguishing clinically relevant ASD subtypes.
Objectives: We aim to improve our ability to identify ASD cases from claims data, exploiting the full amount of variability in ICD-9-CM diagnoses, using machine learning and latent class analysis.
Methods: We used data from the Boston Birth Cohort (BBC), a prospective birth cohort that enrolls predominantly urban, low-income minority mothers and their children. We restricted our analysis to the 2992 children with claims data available from the era of ICD-9-CM (1 Oct 2003 – 30 Sept 2015). Of these children, 771 were given the Social Communication Questionnaire (SCQ) by research staff.
In the 771 patients with SCQ data, random forests were used to identify the specific ICD-9-CM codes, out of over 2500 unique codes present in the claims data, most predictive of the continuous SCQ score. The codes with the highest importance criteria in the random forest were used as indicators in a Latent Class Analysis (LCA) of the full dataset (n=2992).
We compared the LCA-based diagnostic results to using the simple presence of ASD-specific ICD-9-CM hospital diagnosis codes (299.00, 299.80, 299.90) from pediatric outpatient, inpatient, and emergency room visits, which is the current standard in studies that are limited to claims data.
Results: Â Using random forests, we identified the 14 ICD-9-CM codes most predictive of SCQ score. These codes were used as indicators in LCA of the full dataset (2992 children). LCA identified four classes among the subjects; one class (93% of the sample) had a low probability of a 299 code or other developmental diagnoses (normal class), while one class (4% of the sample) had a high probability of carrying a 299 diagnosis (ASD-type class). When compared to the standard ASD definitions (n=120), the ASD-type class derived from LCA was smaller (n=113). There were 9 children who carried a 299 code but did not cluster within the ASD-type class; and there were 2 children who did not carry a 299 code but were assigned to the ASD-type class on the basis of other characteristics. These children may represent false positive and false negative ASD cases, respectively, when using the standard ICD-9-CM-based identification.
Conclusions: Machine learning and LCA show promise in improving ICD-9-CM-based ASD case identification. This may also help in identifying subgroups of children with ASD based on their clinical heterogeneity.

177 **143.177** In Utero Pyrethroid Pesticide Exposure and Child Cognitive Development from 6 to 36 Months in the Marbles Longitudinal Cohort

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Background: Associations between prenatal pesticide exposure and both autism spectrum disorder (ASD) and cognitive delays have been reported. Pyrethroid pesticides have neurotoxicological properties but little is known about the effects of *in utero* exposure on child development.
Objectives: Assess the relationship between pyrethroid pesticide exposure during pregnancy and child cognitive development from 6 - 36 months.
Methods: Mother-child pairs (n=134) in the MARBLES (Markers of Autism Risk in Babies-Learning Early Signs) longitudinal birth cohort were examined. This cohort enrolled pregnant women who already had a child with ASD and, therefore are at increased risk (up to 20%) for having another child who will develop ASD. Maternal urine samples comprising an individual spot urine and a pooled sample of 3 individual spot urine samples (each at least a week apart), from each of the latter 2 trimesters were analyzed for pyrethroid metabolite 3-phenoxybenzoic acid (3PBA). To adjust for urine dilution 3-PBA concentrations were specific gravity (SG) corrected. To assess average exposure during the pregnancy period concentrations of 3-PBA from urine samples collected during each trimester of pregnancy were averaged and the intraclass correlation coefficient (ICC) and total number of urine samples for each pregnancy were used to compute weights for linear regression models of average 3-PBA concentration during pregnancy and Mullen Scales of Early Learning (MSEL) scores.
Results: Subjects had median SG-adjusted 3-PBA concentration= 0.78 ng/ml and ICC = 0.34. After applying weights to 3PBA concentrations and adjusting for SG, child's sex, prenatal vitamin use and maternal education, we found significantly lower MSEL Composite (β= -0.79, *p*=0.003), Visual Reception (β= -0.80, *p*=0.001), and Fine Motor (β= -0.32, *p*=0.02) scores at 6 months.
Conclusions: This may be the first study to assess a biomarker of pyrethroid exposure, with the use of multiple urine samples, from both the 2nd and 3rd trimesters during pregnancy in relation to child cognitive development from 6-36 months. We observed lower scores on the MSEL at 6 months however this effect was attenuated by 12 months. These findings suggest *in utero* 3-PBA concentrations are not strongly related to child cognitive development. Previous literature on this topic is inconsistent, which in part could be due to exposure misclassification because previous studies used a single spot urine sample to assess exposure. A single urine sample from pregnancy will not capture long-term exposure for pyrethroids due to their quick metabolism. *A priori* we had expected that if prenatal pyrethroid exposure affected child cognition, this effect would be consistent across ages. The 6-month results could be a chance finding and/or the lack of association at 12 months or older could reflect confounding factors that are influential at later ages. These are preliminary findings from an ongoing study. Results will be updated with a larger sample, more rigorous measurement error modeling approaches, results from additional urine samples, and analyses of trimester specific 3-PBA concentrations.

178 **143.178** Infections in Children with Autism Spectrum Disorder: Study to Explore Early Development

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Background:
Immune system abnormalities have been widely reported as a component of autism spectrum disorder (ASD); childhood infections may be an expected outcome of these abnormalities. In addition, there have been some limited studies linking childhood infections, including ear infections and specific viral infections, to autism. However, these studies have provided mixed results. Further, potential differences in infection risk in regressive versus non-regressive ASD have not been extensively examined.
Objectives:
We examined caregiver report of clinically diagnosed infections in (1) children with ASD compared to non-ASD developmentally delayed/disordered (DD) controls and to non-ASD population (POP) controls and (2) children with regressive ASD compared to children with non-regressive ASD.
Methods:
The Study to Explore Early Development is a multi-site case-control study of ASD that enrolled children aged 30-68 months. ASD cases (n=707) were determined using standardized diagnostic instruments including the Autism Diagnostic Observation Schedule and the Autism Diagnostic Interview, Revised. DD controls (n=690) were recruited from educational or clinical settings. POP controls (n=898) were ascertained from birth certificates. Children with regressive ASD (n=310) were identified using Early Development Questionnaire (EDQ) scores. Whether the child ever had a clinically diagnosed infection in the first 3 years of life was reported by the child's primary caregiver. Associations between ASD and having ever had an infection were examined using multivariable logistic regression models adjusted for child sex, birthweight and gestational age, maternal race/ethnicity and education, and number of children in the home. Associations between regressive ASD and having ever had an infection were examined using multivariable logistic regression models, adjusted for child sex and maternal race/ethnicity and education. All analyses included a random intercept for enrollment site.
Results:
At least one clinically diagnosed infection in the first 3 years of life was reported for 51.5% of children with ASD, 40.3% of POP controls and 49.2% of DD controls; 34.6%, 33.4% and 37.2% of ASD, POP, and DD children, respectively, had more than one such infection. The odds of ever having had a clinically diagnosed infection were 1.6 times higher in ASD cases compared to POP controls (adjusted OR [aOR] = 1.6 [95% CI: 1.3, 2.0]). ASD cases and DD controls did not differ in their odds of ever having a clinically diagnosed infection before the age of 3 (aOR = 1.9 [0.9, 1.4]).
Among ASD cases, 50.9% of those with regressive ASD had ever had an infection compared to 53.9% of those with non-regressive ASD, while 33.1% and 37.1% of regressive ASD cases and non-regressive ASD cases, respectively, had more than one infection in the first 3 years of life. Those with regressive ASD did not differ in their odds of ever having an infection compared to those without non-regressive ASD (aOR = 1.2 [0.9, 1.6]).
Conclusions:
These results support earlier reports of greater infectious disease risk in children with ASD, but the risk does not appear to be unique to ASD overall, or regressive ASD specifically. An increased risk for childhood infections may be a shared feature among children with adverse neurodevelopmental outcomes.

179 **143.179** Investigating Polychlorinated Biphenyls and Cytokines in Autism Spectrum Disorder

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Background: Polychlorinated biphenyls (PCBs) are persistent organic pollutants known to adversely affect neurodevelopment. Both cytokines and PCBs have independently been hypothesized to play a role in etiologic pathways of ASD, and PCBs have been shown to alter cytokine profiles. However, no study has examined the potential for cytokines to act as an effect modifier of the association between PCBs and ASD.
Objectives: This study examined whether there is an association between prenatal exposure to PCBs and ASD in a risk-enriched pregnancy cohort. This study also assessed whether levels of selected maternal circulating cytokines altered associations between PCBs and ASD.
Methods: Data are from the Early Autism Risk Longitudinal Investigation (EARLI) study, a risk-enriched longitudinal cohort in which women who had a child with ASD were enrolled during a subsequent pregnancy and followed through the sibling's third year of life. Based on clinical assessment at 36 months using DSM-5 criteria, 37 children were diagnosed with ASD, and 127 were non-cases and included in these analyses (n=164). Concentrations of 37 PCB congeners were measured in second trimester maternal serum samples; 29 cytokines and chemokines were measured in first available maternal plasma samples. Twelve PCB congeners (28, 74, 99, 118, 138/158, 153, 170, 180, 187, 194, 196/203, 199), a summed measure of all 12 congeners, and six cytokines (IL-1β, IL-2, IL-4, IL6, IL-8, and IFN-λ) had >60% of measures above limits of detection and were included in further analyses examining odds of ASD relative to typical development. Multivariable logistic regression analyses adjusting for maternal race and education, parity, smoking during pregnancy, and gender of child were run to assess the association between PCB congeners and ASD, parameterizing PCB concentrations in tertiles. The potential for effect modification by cytokine concentration was explored by comparing PCB levels in ASD cases and non-cases in subgroups defined by cytokine concentration above or below the median.
Results: PCB congeners 138/158 and 153 had the highest concentration in the total study population. There were no statistically significant differences in geometric means of individual prenatal PCB concentrations in ASD cases and non-cases. Adjusted associations were also not statistically significant. PCB 99 had the largest odds ratio estimate, OR=3.66, but the associated 95% C.I. was very wide (0.84-15.84) and two congeners, PCB 28 and 153, had adjusted OR point estimates below 1.0, also with wide confidence intervals. There was no suggestion of potential effect modification of PCB and ASD associations by cytokine level in our preliminary explorations.
Conclusions: The results of these analyses with prospectively collected biomarkers do not provide evidence supporting an association between prenatal PCB exposure and ASD risk. However, these results were based on only 164 subjects, and further investigation of prenatal exposure to these and other persistent organic pollutants is needed.

180 **143.180** Linking Department of Children's Services Records with ADDM Population Surveillance Methods

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Background: Â Children with Autism Spectrum Disorder (ASD) and Intellectual Disability (ID) are thought (1) to be at increased risk for maltreatment and (2) to encounter the juvenile justice system at higher rates than children without these specific neurodevelopmental conditions. While previous work has linked educational classifications of developmental disabilities to child maltreatment concerns (Sullivan & Knutson, 2000), larger epidemiological studies specifically addressing ASD within child protection systems are more limited.
Objectives: Â The objectives of the current work were to utilize (1) identify potential ASD/ID cases in the Vanderbilt University Medical Center's (VUMC) electronic medical system using Centers for Disease Control and Prevention (CDC) Autism and Developmental Disabilities Monitoring network methodology (2) link identified children through Tennessee's Department of Children's Services database of encounters related to maltreatment and the juvenile justice system.
Methods: Â Tennessee's current ADDM surveillance cycle population includes 11 counties within middle Tennessee region; 28,414 postcensal estimate of eight-year olds born in 2006. Potential ASD/ID cases were identified by searching specific ASD/ID-related ICD codes and identifying behavioral triggers within comprehensive developmental evaluations in the VUMC medical record. Using an algorithm based on SSNs, names, and dates of birth these records were then linked to Tennessee's Department of Children's Services database (TFACTS) for evidence of any DCS involvement among this group of potential ASD/ID cases.
Results: Â This initial search through the VUMC medical records using ADDM methodology resulted in 421 potential ASD/ID cases. 153 of these children were also identified in the DCS system. This suggests individuals with ASD/ID symptomatology have a greater than 1 in 3 chance of having an encounter with DCS.
Conclusions: Â Past work on the prevalence of youth with psychiatric disorders in the juvenile justice system and in state custody (e.g., foster/adoptive placements) has consistently documented high rates of behavioral challenges. However, several methodological hurdles have limited understanding of the prevalence of children with ASD and ID within these care systems. Specifically, such investigations have often relied on reporter and/or survey strategies, focused on selected subsamples of convenience, and relied on small sample sizes. By using ADDM surveillance methodology we have been able to suggest that over 36% of identified potential ASD/ID cases have also had encounters with DCS.

181 **143.181** Is There Evidence of Intergenerational Influences on Autism?

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Background: Mammalian experiments and human observations indicate that population variation in development and health is influenced by the early-life experience of parents and ancestors (Pembrey et al J Med Genet 2014; 51:563). For example, smoking in pregnancy by either grandmother is associated with the grandchildren's growth patterns in a sex-specific manner (Golding et al Am J Hum Biol. 2014; 26:731).
Objectives: We aimed to determine whether similar intergenerational effects of prenatal smoking could be demonstrated for autism.
Methods: We have used grandmothers' smoking behavior to test for associations with autism and autistic traits in their grandchildren. The Avon Longitudinal Study of Parents and Children (ALSPAC), which enrolled pregnant women in 1990-1992 has information on prenatal exposure of father (n=9677) and mother (n=12,707). Follow up of their offspring includes four traits independently predictive of autism, plus autism diagnosis itself. Trait measures used, identified in ALSPAC (Steer et al PLoS One 2010; 5(9):e12633), cover Social Communication, Speech Coherence, Repetitive Behaviour, and Sociability Temperament. The most extreme ~15% of each were used as outcomes in the analysis. Adjusted analyses took account of various features of the grandparents including years of birth, ethnic origin, ages, social categorisation and education level; separate analyses subdivided the data according to the sex of the child, and whether or not the study mother herself smoked prenatally.
Results: Three of the four traits tested showed an association with maternal grandmother smoking when pregnant. For two traits the effect sizes were greatest if the study child was a girl and the mother did not smoke e.g. for Social Communication the adjusted odds ratio (AOR) was 1.67 [95% CI 1.25, 2.25] (P= 0.001) and for Repetitive Behaviour 1.48 [1.12, 1.94] (P=0.005). The trait Speech Coherence showed a marginal effect with grandsons AOR 1.24 [1.02, 1.50] (P=0.030) but not granddaughters. 170 children monitored through pregnancy had a diagnosis of autism, again associated with maternal grandmother smoking in pregnancy when the mother did not smoke; AOR 1.53 [1.06, 2.20], (P=0.022). There were no associations with prenatal exposure of the study father.
Conclusions: There is evidence that some of the more extreme levels of behaviour traits predictive of a high risk of autism have an association with mothers (but not fathers) who have been exposed to their own mother smoking during pregnancy. Assuming that these findings are replicated in other studies, they raise the possibility that transgenerational exposures of other substances may influence the risk of traits leading to autism.

182 **143.182** Mercury Exposure in Pregnancy and Diagnosed Autism and Autistic Traits in the Offspring: Results from a Prospective Birth Cohort

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Background: For several decades mercury has been suspected of causing autism, leading to alarm over thiomersal-containing vaccinations and eating fish during pregnancy. Reviews of the literature have found few robust studies. The only prospective longitudinal study, based in the Seychelle islands, found no association between prenatal mercury levels and an autistic trait measure. Numbers were too small to assess relationships with diagnosed autism. Thus there is a need to determine whether there is prospective evidence of links between fetal exposure to mercury and autism or autistic traits.
Objectives: To determine the association between 1) prenatal exposure to mercury and 2) indirect measures of mercury levels during pregnancy, and the risk of diagnosed autism and of autistic traits in the offspring.
Methods: In the Avon Longitudinal Study of Parents and Children (ALSPAC), a large prebirth cohort in England, we used three strategies: (1) direct comparison of prenatal mercury levels in 48 cases of autism with 3837 controls; (2) comparison of prenatal mercury levels in those with high scores on each of four autistic traits with the rest of the population at risk (n~2800); (3) indirect measures of association of these outcomes with proxies for increased mercury levels such as frequency of fish consumption, and exposure to dental amalgam (n > 8000). We used logistic regression models adjusted for various potential confounders including maternal age, housing circumstances, maternal education and parity.
Results: The mean maternal whole blood mercury in the pregnancies resulting in an offspring with diagnosed autism was 2.10µg/L [SD 0.95] compared with 2.08[1.09]µg/L for the rest of the population. There was no evidence of an adverse effect of rising mercury levels on diagnosed autism [adjusted odds ratio (AOR) 0.89; 95% CI 0.65, 1.22] per SD of mercury (P = 0.485) or on any of the autistic trait measures. The proxy measures of exposure to mercury reported by the mothers also gave no indication of adverse associations with any of the autistic traits or of diagnosed autism.
Conclusions: There was no evidence that maternal prenatal blood mercury levels, or proxies for increased mercury exposure were associated with autism or autistic traits in this large population based study with prospective data.

183 **143.183** Maternal Height in Relation to Autism Spectrum Disorders in Offspring

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Background: Increased testosterone levels and hyper-masculine physical traits have consistently been identified in individuals diagnosed with autism spectrum disorder (ASD); however, if parental risk factors such as increased testosterone are identified, then earlier prevention could be implemented.
Objectives: This project's aim is to examine whether maternal height, as a surrogate exposure variable for maternal testosterone, has an association with risk of bearing a child with ASD.
Methods: A subset of 121 children from the MARBLES cohort was included in a crude regression model. The MARBLES cohort, established in 2006 at the UC Davis MIND Institute in Sacramento, CA, is an ongoing prospective pregnancy cohort study. The cohort population is comprised of the younger sibling in high-risk families having at least one previous child with ASD, residing within 2.5 hours driving distance of the MIND Institute. The diagnostic criteria for an outcome of ASD or typical development was derived from an algorithm including scores on Mullen Scales of Early Learning and Autism Diagnostic Observation Schedule (ADOS) assessments at 36-months of age. Maternal height (cm) was collected and verified through medical records, maternal medical abstraction forms, environmental exposure questionnaires, and food frequency questionnaires. Logistic regression was performed to estimate the association between maternal height and ASD risk.
Results: No association between maternal height and ASD risk was found (OR=1.018, 95% CI: 0.967-1.072).
Conclusions: Â Crude evaluation of the relationship between maternal height and ASD did not find a link. Further analysis will be conducted to adjust for possible confounding and verify this lack of association. In addition, future work includes determining the validity of using maternal height as a surrogate variable for maternal testosterone by comparing height with measured testosterone, and studying the relationship between gestational testosterone concentrations and the child's ASD risk.

184 **143.184** Maternal Smoking during Pregnancy and Autism: Applying Genetic and Epigenetic Approaches in a Birth Cohort Study.

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Background: An association between maternal smoking in pregnancy and autism may be biologically plausible, but the evidence to date is inconsistent. In particular, it is difficult to rule out the possibility of unobserved or residual confounding when investigating causal effects in observational studies. One way to address this is by using genetic variants as proxies of exposure in a Mendelian randomization framework. Furthermore, the possibility of measurement error in self reports of smoking is difficult to address. Since smoking during pregnancy is robustly associated with changes in DNA methylation, using this information by means of an 'epigenetic score' for smoking may be more reliable than self-reported smoking.
Objectives: We aimed to investigate the causal relationship between maternal smoking during pregnancy (measured by self-report and by a DNA-methylation score) and offspring autism and autistic traits using conventional analysis, Mendelian randomization and paternal smoking as a negative control.
Methods: We used data from the Avon Longitudinal Study of Parents and Children (ALSPAC), a large birth cohort study in the Bristol and surrounding areas of the UK. We investigated the effect of maternal smoking during pregnancy (exposure) on autism diagnosis and high scores on four autistic traits (outcomes) including the Social and Communication Disorders Checklist (SCDC) score, the Childhood Communication Checklist (CCC) coherence score, a score for repetitive behavior, and sociability subscale of the Emotionality Activity and Sociability temperament score. Maternal prenatal smoking was self-reported and also identified by computing a well-characterized DNA methylation score for adult smoking in the mothers when they were pregnant. Partners' smoking during pregnancy was used as a negative control for intrauterine exposure. Mendelian randomization was carried out using the genetic variation at the *CHRNA3*locus in maternal DNA, as a proxy for heaviness of smoking.
Results: In conventional analysis, there was an association between smoking during pregnancy and impairments in social cognition [OR=1.52, 95% CI=1.20,1.92] and repetitive behaviors after adjusting for sex, maternal age, parity, maternal education, social class and financial difficulties. There was no evidence of such associations for the other traits or a diagnosis of autism. Paternal smoking was also associated with similar odds as for mothers, of impairments in social cognition [OR=1.44, 95% CI=1.15,1.81] and repetitive behaviors suggesting shared confounding. There was no evidence of an association of smoking exposure measured through DNA methylation on the autism traits. Genetic variation at *CHRNA3* for heaviness of smoking was not associated with ASD or any of the autistic traits.
Conclusions: Our results do not support a causal association between maternal smoking during pregnancy and offspring autism or autistic traits. Previous studies finding such an association may have been prone to residual confounding.

185 **143.185** Medical History of Discordant Twins Indicates Environmental Etiologies of Autism

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Background: The environmental contributions to Autism Spectrum Disorder (ASD) and their informative content for diagnosing the condition are still largely unknown. The assessment of monozygotic (MZ) twin pairs discordant for a phenotype, is a powerful design for exploration of environmental components in the etiology.
Objectives: The objective of this study was to investigate associations between ASD and early medical events and characteristics, in twins. In particular, the aim was to test the hypothesis of an environmental cumulative effect on ASD risk.
Methods: A total of 80 MZ twin pairs (13 were discordant for clinical ASD diagnosis) and 46 dizygotic (DZ) twin pairs, were examined for intra-pair differences in early medical events (e.g., obstetric and neonatal factors, first year infections) using anamnestic survey data. First, differences in early medical events were investigated using multisource medical records in the rare subsample of MZ twin pairs qualitatively discordant for ASD and matched typically developing (TD) pairs (N=52). Second, identified intra-pair differences specific to ASD diagnoses were tested in relation to autistic traits inÂ an independentÂ sample of quantitative discordant pairs (N=200), applying generalized estimating equations analyses.
Results: Intra-pair differences in both clinical ASD (Z=-2.85, p= .004) and autistic traits (β=78.18, p=.002) were associated with the cumulative load of early medical events when controlling for IQ and ADHD comorbidity in MZ pairs. This association wasÂ particularly drivenÂ by increased infant dysregulation (feeding, sleeping abnormalities, excessive crying and worriedness). NoÂ significant association were found in DZ pairs.
Conclusions: Â Early dysregulation, and foremost the cumulative load of early medical events, may index children at risk of ASDÂ owing to non-shared environmental contributions. Findings could facilitate screening and early detection of ASD.

186 **143.186** Is the Prevalence of Autism Associated with Maternal Ethnicity and Nativity?

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Background:
The prevalence of autism is highly variable within and across geographic regions (Elsabbagh et al., 2012 Aut Res). Several factors have been proposed to explain this variability. Among these factors are differences in level of awareness and recognition as well as the availability of services in different communities. Previous research has suggested that socio-demographic factors such as maternal ethnicity and nativity are associated with prevalence, which may in turn explain some of the variability in estimates.
Objectives:
We conducted a systematic review to establish the reliability of association between sociodemographic factors and autism prevalence.
Methods:
We searched Medline and PsychInfo for manuscripts where association between autism prevalence and sociodemographic factors was investigated. We included research articles exploring ethnicity and nativity or immigration in relation to autism regardless of their design. By following PRISMA guidelines, this approach allowed for inclusion of large population studies from which quantitative data can be extracted to compare relative risk between groups as defined by these sociodemographic variables. Non-original articles and those not reporting prevalence estimates were excluded.
Results:
Our search identified 130 records, from which we retained 44 full text articles after screening and application of inclusion and exclusion criteria. Of these 16 original articles reported sufficient data on the association between prevalence and sociodemographic risk factors to be included in the final analysis. A meta-analysis was possible to conduct only for immigration status, where data extraction provided clearly differentiated risk estimates for immigrants vs. non-immigrants. The total population included in the analysis was 76.7 Million (321,188 individuals with ASD). Relative risk was 0.947 in immigrant group versus non-immigrant (CI- 0.66- 1.35, P<0.001). However, we also found significant heterogeneity in the estimates (Q = 1518.04, p < .0001), limiting confidence in the findings of the meta-analysis.
Conclusions:
Several strong claims have been made in the literature regarding the association between socio-demographic factors and autism prevalence. Our finding, using a systematic review methodology, suggests that the number of studies and their quality limits the validity of these claims. Our review also identified sampling biases where risk factors like ethnicity and immigration are more often than not confounded by other socio-demographic factors. Future studies need to also shift from post-hoc accounts and toward specific and biologically plausible hypotheses explaining how sociodemographic factors might impact autism prevalence.

187 **143.187** Metabolic Programming of Child Gastrointestinal Symptoms in Children with Autism Spectrum Disorder

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Background: Gastrointestinal (GI) symptoms are highly prevalent in children with autism spectrum disorder (ASD), and growing evidence suggests that their etiology involves alterations in gut microflora, intestinal permeability, and activation of specific immune and metabolic pathways.
Objectives: Our goal was to explore whether fetal programming via maternal dysmetabolism during gestation might be associated with GI symptoms in child participants in the CHARGE (CHildhood Autism Risks from Genetics and the Environment) study.
Methods: The CHARGE Study is a population-based case-control investigation of ASD etiology. Children aged 24-60 months and living in catchment areas with a biological parent fluent in English or Spanish were enrolled 1/29/2013-5/7/2013. Children with ASD (n=550) and delayed development (DD, n=218) were recruited through the California Department of Developmental Services, the Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, and referrals. Controls with typical development (TD) (n=425) were randomly selected from birth records and frequency-matched on age, sex, and broad geographic region. Diagnoses of maternal metabolic conditions – including prepregnancy obesity, diabetes and chronic hypertension; maternal irritable bowel syndrome (IBS); mode of delivery and duration of breastfeeding were drawn from medical records and responses to structured interviews. Child GI symptoms of interest were drawn from maternal report, and included frequent diarrhea or constipation within three months of enrollment or at any time in the past. The Autism Diagnostic Observation Schedule and Autism Diagnostic Interview-Revised were used to confirm ASD, whereas children with DD and TD were confirmed by Mullen Scales of Early Learning and Vineland Adaptive Behavior Scales and were free of ASD symptoms.Â Preliminary analyses of symptom frequencies were compared across groups using Chi-square tests.
Results: Â As reported previously, both past and recent diarrhea and constipation frequency were 4-6 times more common in children with ASD and DD compared to TD controls (26.0%, 18.8% vs. 4.7%; p<0.0001). Current and past GI symptoms were more common in children born to mothers diagnosed with metabolic conditions (23.7% vs. 16.7%; p=0.07). Statistically significant differences were seen in children born by cesarean (19.5% vs. 14.7%; p=0.04), and whose mothers had IBS (28.7% vs. 15.1%; p=0.002). In analyses stratified by diagnostic group, current GI symptoms remained more prevalent in all children whose mothers had IBS (ASD: 34.1% vs. 24.1% p=0.15; DD: 40.0% vs. 18.2% p=0.04; 14.3% vs. 3.4% p=0.01).
Conclusions: Our findings support a relationship between maternal dysmetabolism during pregnancy and increased frequency of GI symptoms in children, suggesting a disruption in the development of beneficial gut microflora in the offspring. Metabolic conditions are associated with both IBS and labor complications that increase risk for cesarean delivery. Children of mothers with IBS or birth by cesarean were likely to have frequent GI symptoms. It has been postulated that cesarean birth alters "seeding" of the intestinal microbiome, leading to long-term changes in colonization and immune development.Â Other environmental and genetic factors likely play a role in GI disturbances particularly prevalent among children with ASD or DD. Further efforts are needed to characterize mechanisms underlying the relationship between maternal dysmetabolism and GI symptoms in the offspring.

188 **143.188** Neonatal Jaundice in Association with Autism Spectrum Disorder in the Child

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Background: Several neonatal complications have been studied in association with autism spectrum disorder (ASD). The most common complication, neonatal jaundice, is inconsistently defined across studies and is also inconsistent in showing an association with ASD. However, neonatal jaundice can be indicative of high bilirubin levels that may result in neurological damage and should be appropriately investigated in association with ASD.
Objectives: To examine associations between neonatal jaundice or hyperbilirubinemia and ASD in 2-5 year old children.
Methods: Our analysis uses the Study to Explore Early Development (SEED), a multi-site, case-control study. Children born from 2003-2006 were enrolled in SEED at 2 to 5 years of age. Developmental assessment in the clinic was used to classify children into three groups based on presence of ASD (n=702), a wide-range of non-ASD developmental delays or disorders (DD; n= 891), or non-ASD controls drawn from the general population (POP; n=983). Infants with jaundice in the first 28 days of life were identified from neonatal medical records and maternal interviews. A diagnosis was classified as definite if the infant received treatment for jaundice, as probable if there was no treatment but a diagnosis was available in the medical record, or possible if the mother reported jaundice, but there was no medical record (16%), it was not complete (19%), or it was complete but no jaundice or treatment reported (65%). Hyperbilirubinemia was classified using bilirubin levels, when available in the medical record. We examined the associations between neonatal jaundice and case status (ASD and DD groups to POP), as well as hyperbilirubinemia and case status, using adjusted multivariable logistic regression models. Odds ratios were adjusted (aOR) for sex, race/ethnicity, gestational age, maternal age, maternal education, maternal diabetes, and parity.
Results: From a sample of 2,576, we identified 1,239 infants (48.1%) with neonatal jaundice, of which 626 (50.5%) were definite, 378 (30.5%) were probable, and 235 (19%) were possible. Of 1,419 infants born ≥35 weeks gestation with bilirubin levels available, 88 (6%) were classified as having hyperbilirubinemia (bilirubin levels in the 95thpercentile). For neonatal jaundice in association with ASD vs. POP, we obtained an aOR=1.17 (95% confidence interval (CI) 0.93, 1.47). A slightly stronger, non-significant association with ASD vs. POP was observed for definite jaundice (aOR=1.29; 95% CI 0.95, 1.75). No associations were found for probable or possible jaundice and ASD. Significant associations were present when comparing DD vs. POP for neonatal jaundice (aOR=1.34; 95% CI 1.09, 1.65) and for definite jaundice (aOR=1.73; 95% CI 1.32, 2.27). A significant association was also observed for hyperbilirubinemia comparing DD vs. POP (aOR=1.87; 95% CI 1.03, 3.40), but non-significant comparing ASD vs. POP (aOR=1.28; 95% CI 0.65, 2.53).
Conclusions: Our results did not show a statistically significant association between neonatal jaundice and ASD or between hyperbilirubinemia and ASD. However, neonatal jaundice and hyperbilirubinemia were each significantly associated with an increased odds of DD. Further investigations are needed to confirm the association between high bilirubin levels and DD, and if there is a higher risk for any specific developmental disorder.

189 **143.189** Newborn Vitamin D Levels in Relation to Autism Spectrum Disorders; A Case-Control Study in California

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Background: Explanations for the continuing rise in the prevalence of Autism Spectrum Disorder (ASD) are urgently needed, so environmental factors are important to consider, as well as gene-environment (GxE) interactions. Vitamin D deficiency/insufficiency also appears to be increasing over recent decades. Emerging evidence suggests vitamin D may be related to risk of ASD, given advances in the understanding of its role in brain and immune function. Prior studies of ASD have generally examined surrogates of vitamin D (e.g. latitude, season) or levels in children already diagnosed, rather than the more likely susceptibility period during early development.
Objectives: To investigate the association between measured perinatal vitamin D deficiency/insufficiency and ASD in the Early Markers for Autism (EMA) study.
Methods: We conducted a population-based case-control study among children born in 2000-2003 in Southern California whose mothers had participated in prenatal and newborn screening and had banked biospecimens available. Autism (N=563) was identified from the Department of Developmental Services (DDS) and confirmed by expert clinician record review. General population controls (N=436) were randomly selected from birth certificates of children not served by DDS born in the same region and years. 25-Hydroxyvitamin D (25OHD) metabolites were measured in newborn dried blood spots by a sensitive assay, and hematocrit-corrected. The distribution of total 25OHD was compared between ASD cases and controls, and by potential confounding factors. For this presentation we categorized vitamin D levels as deficient (<50nmol/L), insufficient (50-74 nmol/L) and sufficient (≥75 nmol/L). Crude and adjusted odds ratios (AOR) and 95% confidence intervals (CI) were calculated by logistic regression. Further, we examined associations by newborn genotype for SNPs associated with vitamin D levels, and in subgroups defined by maternal race/ethnicity, parity, and child sex.
Results: Â The median OHD level was 85.3 nmol/L; 14% of infants were classified deficient and 26% insufficient. OHD levels were lower (or deficiency more frequent) for winter births, higher birth order, non-White maternal race/ethnicity, and lower maternal education, as well as shorter time to blood draw. OHD levels were similar between cases and controls. Adjusting for a number of potential confounders did not change these patterns; the AOR (95%CI) for deficiency was 0.95 (0.64-1.4) and for insufficiency was 1.2 (0.86-1.6). While some variation in effect estimates were observed among the sub-groups examined, including the genotype at missense SNP rs4588 in vitamin D transport gene *GC,* confidence intervals were relatively wide and overlapped.
Conclusions: This is the first large study to examine newborn vitamin D in relation to autism, with no association seen. The relatively low rate of Vitamin D deficiency limited small sub-group analyses. Prior studies reporting lower Vitamin D levels in children with autism or their mothers, after diagnosis, may reflect current lifestyle and diet. In the more developmentally relevant time period, studies have found lower prenatal maternal OHD levels associated with language difficulties and mental and psychomotor outcomes in offspring, supporting the need for additional research on autism. We plan to examine second trimester maternal vitamin D levels in this study population in the future.

190 **143.190** Patterns of Service Utilization Among Children with Autism Spectrum Disorder: A Cluster-Analysis of the 2011 Pathways to Diagnosis and Services Survey

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Background:
Despite extensive examination of demographic factors such as race-ethnicity and socio-economic status and how they are related to ASD identification, severity, and access to services, research has not been conducted at a nationally-representative level. In addition, cluster analysis as a method has only rarely been applied to this topic. When cluster analysis has been used, it has examined symptoms and phenotypes.
Objectives:
The objective of this project is to determine whether there are groups of children with ASD that have similar patterns of service utilization, access, or treatment type. Subsequent analysis will determine whether these clusters differ with regards to functional status, race, ethnicity, sex, and/or insurance coverage.
Methods:
Data from the 2011 Survey of Pathways to Diagnosis and Services (Pathways) were used in this analysis. Developed as a follow-up to the 2009/10 National Survey of Children with Special Health Care Needs, Pathways measures parental report of the emergence of symptoms, diagnosis, and use of services among children with intellectual disability, developmental disability, and ASD. The sample for this analysis was limited to include only children with complete data on variables of interest in the principal components analysis (n=324). Principal component analysis (PCA) was performed on 39 items from the Pathways Survey related to types of services and medication utilized and services not covered by health insurance. Once factors were determined, summated scores were calculated using the items that comprised each factor. These scores were used to develop a cluster analysis identifying groups of individuals whose service utilization and treatment represent similar, meaningful patterns. Post-hoc analyses were performed to name and describe distinct clusters. Analyses will be performed to examine potential differences between clusters with regards to functional status, race, ethnicity, sex, and/or insurance coverage.
Results:
The PCA revealed four factors related to utilization of medication, school-based, and non-school-based services, as well as report of services not covered by insurance. Four clusters emerged based on these factors. The largest cluster included 36.4% of the sample and was defined by high use of both school-based and non-school-based services with low medication use. One quarter (25.3%) of the sample was characterized by high utilization of both medications and services. The smallest cluster (15.7%) was characterized by high medication usage and low service utilization. The remaining cluster (22.5% of the sample) is characterized by higher levels of "not covered" services according to parents, though there do not appear to be remarkable patterns of lower utilization.
Conclusions:
Results show that there are distinct patterns of how children in the Pathways survey access services. Although the majority of the population in this analysis was defined as having high utilization of services and low medication usage, there were other segments of the population that varied in the utilization of service and medication usage. This suggests that the access issues may be related to demographics, access to care, and severity. Subsequent analyses studies will explore differences between clusters and potential disparities.

191 **143.191** Prenatal Air Pollution Exposures, Maternal Cytokine/Chemokines, and Risk of Autism Spectrum Disorder: The Early Markers for Autism (EMA) Study

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Background: Increasing evidence suggests that both air pollutants and immune system dysregulation may be associated with adverse neurodevelopmental outcomes, including autism spectrum disorder (ASD). The relationship between these two risk factors has not been studied prenatally.
Objectives: In this study, we examined the relationship between mid-gestational air pollution exposures and levels of maternal serum cytokines/chemokines to determine their potential combined associations with risk of ASD.
Methods: Study participants were from a large population-based, nested case-control study of archived maternal mid-pregnancy specimens from the same mother-infant pairs from Southern California. Study groups were identified through the linkage of California birth records, Department of Developmental Services (DDS) records, and the California Prenatal and Newborn Screening Program records. This study includes mothers of children with ASD (n=378), intellectual disability (ID) but not ASD (ID; n=165),or children with no known neurodevelopmental disability from the general population (GP; n=416). The ASD group was further divided into those with ID (DQ<70) (ASD+ID; n=181) and those without (DQ ≥70) (ASD-noID; n=197). To estimate air pollutant exposure during the second trimester of pregnancy, maternal residential addresses reported during prenatal screening visits and on the infant's birth certificate were used. Regional air pollutant measures (NO_2, PM_{10}, $PM_{2.5}$, Ozone, NO) based on the Environmental Protection Agency's Air Quality System data were averaged for one month before the maternal serum sample collection date. Stored maternal serum samples, collected during weeks 15-19 of gestation for routine prenatal screening, were quantified for 22 cytokines/chemokines using Luminex multiplex analysis technology. Correlations between prenatal levels of air pollutants and maternal cytokines/chemokines were examined separately for each case group using Spearman's correlation. Resulting correlations were then compared between each diagnostic group and GP controls using Fisher's z-transformation to assess whether correlations between exposures and cytokine/chemokines differed across groups.
Results: The correlation between measured air pollutants and maternal cytokines/chemokines were generally weak (<0.2 in absolute value). Distinct patterns of correlation between cytokines/chemokines and air pollutants were observed for each diagnostic group. For example, the correlations between the allergy and asthma-associated cytokine IL-4 and NO_2 (p=0.03) and PM_{10} (p=0.01) differed significantly between the ID and GP groups, and were greater in magnitude among ID, while a significant difference in the magnitude of correlation between ozone and IL-4 showed an inverse relationship in ID (p=0.01). The magnitude of association between IL-4 and ozone was significantly different for ASD+ID than for GP (p=0.04) and showed inverse association among ASD+ID. No significant differences in the magnitude of correlation between air pollutants and cytokines/chemokines were found between ASD-noID and GP groups. Additional analyses will quantify relationships between ASD risk and joint effects of air pollution and maternal immune markers, as well as explore potential mediation.
Conclusions: Correlations between mid-gestational maternal cytokines/chemokines and air pollutants varied in direction and magnitude across the different diagnostic groupups. The observed relationships between prenatal air pollutant exposures and maternal cytokines/chemokines may thus provide further insight of their potential role(s) in neurodevelopment, particularly in the context of risk of ASD and ID.

192 **143.192** Prenatal Polybrominated Diphenyl Ether (PBDE) Exposure and Social Cognition at Age 14

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Background: An accumulating body of literature has linked prenatal exposure to polybrominated diphenyl ethers (PBDEs), chemicals used as flame retardants in furniture, electronics, textiles and other consumer products, to behavior problems in childhood, suggesting that PBDEs may act as developmental neurotoxicants in humans. Epidemiologic findings to date on PBDE exposure and autism spectrum disorder (ASD) are very limited. In the CHAMACOS (Center for the Health Assessment of Mothers and Children of Salinas) study, a birth cohort of predominantly Mexican-Americans in an agricultural region of California, prenatal PBDE exposure was associated with poorer attention, fine motor coordination, and cognition at ages 5-7 and poorer attention and executive function at ages 9-12.
Objectives: To examine the influence of prenatal exposure to PBDEs on social cognition, a trait impaired in individuals with ASD, in early adolescence.
Methods: We measured concentrations of 4 common PBDE congeners (BDE-47, 99, 100, 153) in blood contributed by CHAMACOS mothers during the second half of pregnancy (in 2000-2002). When children were aged 14 years, parents completed the Social Responsiveness Scale, Second Edition (SRS-2), a rating scale of traits related to ASD. Using generalized additive models, we examined associations of serum lipid-adjusted PBDE concentrations in relation to sex-standardized SRS-2 T-scores (population standard mean=50, standard deviation=10), with adjustment for child's age at SRS-2, breastfeeding duration, household income, maternal characteristics (age, parity, education, country of origin, years in the United States, pre-pregnancy body mass index, and IQ), and measures of maternal depression and support for cognitive development in the home.
Results: 147 children with SRS-2 scores, prenatal PBDE measures, and relevant covariates were included. Median (25%—75%) serum lipid-adjusted PBDE concentrations were: 15.0 ng/g lipid (8.7—24.5) [BDE-47], 3.7 (2.4—6.9) [BDE-99], 2.4 (1.6—4.2) [BDE-100], 2.0 (1.4—3.6) [BDE-153]. SRS-2 T-scores ranged from 41—88 with a mean (standard deviation) of 55.3 (7.8). Relationships of SRS-2 T-scores with log10-tranformed PBDE concentrations appeared linear, and scores were higher (representing more autistic behaviors) among children whose mothers had higher concentrations of BDE-153 in pregnancy (β=3.5; 95% confidence interval (CI): -0.5, 7.5 per 10-fold increase in maternal BDE-153 concentration). SRS-2 scores did not appear associated with the other measured PBDE congeners or the sum of the four PBDE congeners (β=0.7; 95% CI: -3.0, 4.4).
Conclusions: Among young adolescents living in a low-income agricultural community, behaviors related to ASD appeared somewhat elevated in those with higher prenatal exposure to BDE-153, but not other measured PBDEs. BDE-153 is a component of the commercial flame retardants penta- and octabromodiphenyl ethers (penta- and octaBDEs), which were phased out of production in the United States in 2004 due to concerns about potential toxicity, but remain present in older consumer products.

193 **143.193** Prenatal Serum Levels of Brominated Flame Retardants in Association with Autism Spectrum Disorder and Intellectual Disability: Potential Sex Differences

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Background: Prior work suggests prenatal exposure to polybrominated diphenyl ethers (PBDEs) may have neurodevelopmental impacts. However, few human studies have prospectively examined levels of these chemicals during suspected critical windows of neurodevelopment in association with autism and other developmental disorders.
Objectives: To determine whether prenatal exposure to brominated flame retardants influences risk of autism spectrum disorder (ASD) or intellectual disability without autism (ID).
Methods: We conducted a population-based case-control study. Participants were from the Early Markers of Autism (EMA) study. Children with ASD (n=545) and ID (n=181) were identified from the Department of Developmental Services (DDS), with diagnoses confirmed by expert clinician review, and ASD cases meeting Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV-TR criteria. General population (GP) controls (n=418) were randomly selected from birth certificates of the same birth years as cases (2000-2003) after excluding those served by DDS. Concentrations of nine PBDE congeners and 2,2',4,4',5,5'-hexabromobiphenyl were measured in maternal 2nd trimester serum samples. Logistic regression was used to calculate crude and adjusted odds ratios (AOR) for associations with ASD, and separately for ID, compared to GP controls, by quartiles of analyte concentrations in primary analyses. Stratified analyses examined potential effect modification by offspring sex as well as potential differences by ASD with and without comorbid ID. Sensitivity analyses were conducted to test the robustness of results to a number of alternate modeling strategies.
Results: Six congeners were frequently detected in this study population and evaluated in further analysis. Levels of most PBDE congeners were lower in children with ASD or ID relative to GP controls. In adjusted analyses, inverse associations were found for ASD relative to GP, comparing the highest quartile of concentration to the lowest (AOR=0.56, 95% CI 0.38, 0.84 for BDE-153, and AOR=0.54; 95% CI 0.36, 0.80 for the sum of detected congeners). Results differed for odds of ASD when stratified by child sex, with estimates above the null in girls, and confidence intervals closely overlapping 1.0 for BDE-28 and -47. Similar patterns were observed for ID. No differences in risk were noted for ASD with or without ID. Sensitivity analyses did not alter findings.
Conclusions: Contrary to expectation, results did not suggest increased risk of ASD or ID with higher levels of prenatal PBDEs. However, these findings suggest potential sexual dimorphism in neurodevelopmental effects of prenatal exposure to brominated flame retardants.

194 **143.194** Prevalence and Comorbidities of Autism Spectrum Disorder and Study of the Method of the Developmental Health Checkup in a Japanese Community-Based Population Sample of Five-Year-Old Children

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Background: In Japan, local governments perform pregnant women and infants' health check-up as a fundamental maternal-and-child-health service. However, it cannot completely pick up developmental disabilities, especially ASD at 18 months and 36 months old. Therefore, we have conducted five-year-olds developmental health check-up since 2013, and directly diagnosed developmental disorders using DSM-5. It allows investigating the prevalence of developmental disorders, andÂ proposing early identification and intervention.
Objectives: The purpose of this study is to investigate the prevalence and Comorbidities of ASD in a community-based population sample of five-year-old children. We also clarify the difference of clinical data between children with ASD or other developmental disorders and healthy controls.
Methods: This study was conducted as Hirosaki Five years check-up (HFC) study-assessing mental health among children in Hirosaki. Subjects are 3804 children who become 5 years old between April 2013 and March 2016 in Hirosaki city. 2923 children responded to the first screening (parents and teacher filled out ASSQ, SDQ, ADHD-RS, DCDQ, PSI-C). 607 children were above the cutoff point of the screenings. Finally, 440 children and their parents visited to the developmental health check-up including 31 applicants. Pediatricians and psychiatrists diagnosed neurodevelopmental disorder directly using DSM-5 criteria (ASD, ADHD, ID/BI) and EACD criteria (DCD), in addition, psychologists and Occupational therapists evaluated not only ASD symptoms but also cognitive and motor function using WISC-4, MABC-2, SCQ, AQ, PARS-TR short version. We estimated the rate of prevalence and comorbidities. In addition, we verified the availability of the screening and assessment tools.
Results: The prevalence rate of ASD was estimated at 3.20%. The comorbidities of ASD were ADHD (60.0%), DCD (61.1%) and ID/BI (40.0%). In the logistic regression analysis, the primary screenings which are combination of parent-ASSQ, ADHD-RS, PSI-C and teacher's SDQ showed 96.9% prediction diagnostic rate (R^2=.559). Similarly, the secondary assessment tools which are combination of MABC Total, AQ Total and PARS-TR short-version showed 86.2% prediction diagnostic rate (R^2=.479).
Conclusions: This is the first epidemiological study of a community-based population sample in Japan. These findings suggest that ASD children have plural comorbidities, in other words, ASD children suffer from severe disabilities than other disorders. ASSQ, ADHD-RS, PSI-C, SDQ is useful for screening and MABC-2, AQ, PARS-TR is available for diagnosis of 5-year-old ASD children.

195 **143.195** Prevalence of Autism Spectrum Disorders in the Public Schools

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Background: Current estimates of the prevalence of autism spectrum disorders (ASD) in the U.S. are 1 in 68 (1.5%) (Christensen, 2016). However, studies indicate that many children with an ASD health diagnosis do not have an ASD special education eligibility classification within the public schools (Pinborough-Zimmerman et. al, 2012). In the past, identification of ASD within the population has been shown to vary across geographic location and race (Daniels & Mandell, 2014; OSERS, 2016).
Objectives: The purpose of this study was to examine the prevalence rates of children classified as having autism spectrum disorders in special education in the 50 states. Differences in prevalence will be considered across ages groups (i.e., ages 3-5 and 6-12) to determine if older children are more likely to be classified as having ASD within the public schools. In addition, differences across US geographic regions were considered.
Methods: Publically accessible state level Child Count and Educational Environments data from the 2014-2015 school year collected by the US Department of Education (2016) through the *Individuals with Disabilities Education Act* (*IDEA*) Section 618 was used. Data related to the number of children with eligibilities in the areas of autism spectrum disorder and significant developmental delay from the 50 states and the District of Columbia were analyzed (Age 3-5 Autism N = 66,059; age 3-5 Significant Developmental Delay N = 278,194; age 6-11 Autism N= 255,505). In addition, 2014 state population estimates for children ages 3-5 years and 6-11 years were accessed through the US Census Bureau State Characteristics Datasets (US Census Bureau, 2014).
Results: The prevalence rate for children age 3-5 with an autism eligibility was .4% and with a SDD eligibility was 2.9%. There was a significant difference between the ASD eligibility prevalence for children age 3-5 and those age 6-11 (M = .95%; p <.001). For children age 3-5 years, prevalence rates of ASD special education eligibilities are higher in the Northeast as compared to those in the Midwest (p = .015) and South (p = .016). Similarly, for children age 6-11 years, prevalence rates of ASD special education eligibilities are higher in the Northeast as compared to those in the Midwest (p = .020), South (p = .006), and West (p = .013).
Conclusions: Considering the prevalence of ASD is 1.5% of the population and only .4% of young children were found to be receiving ASD specific services in the public schools, there is considerable room for improvement in the early detection of ASD through the public school system. This is of considerable importance as young children with ASD primarily receive intervention services through the public schools (Bilaver et al., 2016). As the public schools in the Northeast US are identifying more children with ASD, it would be beneficial to further explore their processes and resource allocation in order to determine if it could be generalized.

196 **143.196** Puberty Timing and Sexual Attraction in Autism Using a Nationally Representative Sample

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Background:
Past research suggests there is more variation in sexual attraction and puberty timing in individuals with Autism Spectrum Disorder (ASD) using clinical and community samples, however, population representative data is lacking. Both sexual attraction and puberty timing are associated with sex hormones and may therefore inform on the androgen theory of ASD which proposes that excess androgens may cause ASD.
Objectives:
The present study utilised a population representative sample to explore sexual attraction at 14-15 years of age and indicators of puberty timing using data collected over four time points from ages 8-9 to 14-15 years in adolescents with and without ASD.
Methods:
Secondary analyses were undertaken using data from the Kindergarten (K) cohort from the Longitudinal Study of Australian Children (LSAC) which included 94 adolescents (73 males, 21 females) with parent reported ASD and 3,454 adolescents (1,685 males, 1,675 females) without ASD. Adolescents self-reported on sexual attraction. Timing of androgen and oestrogen driven pubertal events included facial hair growth, growth spurt, breast development, body hair, menstruation, and maternal puberty collected by parent report at ages 8-9, 10-11, 12-13, and child self-report at 14-15, were compared in those with and without ASD adjusting for demographic and child factors.
Results:
Adolescent males with ASD reported lower rates of heterosexual attraction (adjusted odds ratio: 0.384, p=.002), and a trend toward higher rates of not feeling any attraction to others (adjusted odds ratio: 2.79, p=.06) compared to non-ASD males. Females adolescents with ASD also reported lower rates of heterosexual preference (adjusted odds ratio: 0.14, p<.001), higher rates of bisexuality (adjusted odds ratio: 6.05, p<.001) and uncertainty in whom they were attracted to (adjusted odds ratio: 10.44, p<.001) compared with non-ASD females. Oestrogen driven puberty indicators (breast development, growth spurt, menstruation) completed earlier in girls with ASD (100% completed by 10-11 years) according to parent report. There was no difference in the timing of androgen driven puberty indicators in adolescent boys and girls with ASD relative to those without ASD. There was no difference in the age of menarche in mothers of girls (p=.71) and boys (p=.59) with or without ASD.
Conclusions:
The findings confirm in a population ascertained sample that adolescents with ASD have differences in sexual attraction compared with non-ASD peers and that these are present by early adolescence. The increased rate of bisexuality in females with ASD is consistent with the androgen theory of ASD, but the decreased rate of heterosexuality in males with ASD and the similarities in androgen driven puberty timing do not support the androgen theory of ASD.

197 **143.197** Record-Based ASD Annual Prevalence for Children Ages 0-8 in Taiwan, 2004-2013

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Background: In the past decade, global prevalence estimates of Autism Spectrum Disorder (ASD) are between 1-2% among children of all ages. Since higher recognition and changes in diagnostic practice and service availability, the number of people with ASD in Taiwan increased 10-20% as compared to a decade ago. However, the data were from the National Disability Registry system in Taiwan only includes children who are eligible for social assistance payments. Taiwan implements a National Health Insurance (NHI) program since 1995. NHI offers comprehensive and universal health insurance to all citizens.
Objectives: The objective of the study was to calculate the annual prevalence of ASD among 0 to 8-year-old children based on the National Health Insurance data from 2004 to 2013.
Methods: The study utilized the NHI database that includes 96% medical claims of all citizens. The diagnosis coding of the national data follows the International Classification of Diseases, Ninth Revision, Clinical Modification diagnostic criteria. Children who were 0 to 8 years old at each year and had an outpatient service claim with a diagnosis of ASD during 2004 to 2013 were defined as the case. The denominator of calculating the prevalence rate was the total number of 0 to 8 years-old children in the database each year. Annual percentage change of prevalence which is the change in rates yearly over 2004 to 2013 was calculated.
Results: The prevalent cases under 8 years of age were increasing from 5,455 cases in 2004 to 7,884 cases in 2013, whereas the total population for the children under 8 years of age were decreasing from 2,437,948 in 2004 to 1,763,147 in 2013. The prevalent rate of ASD increased from 2.24 in 2004 to 4.47 per 1,000 in 2013 (Table 1). The annual percentage change in ASD prevalence was 8.3% per year on average from 2004-2013, with a 99.5% increase from 2004 to 2013.
Conclusions: Â Using NHI claim data in Taiwan, the results showed that ASD prevalence increases over time from 2004–2013. The increasing trends we found is in line with reports from existingÂ studies. The increase of prevalence over the years could be in part due to the increase of awareness of the public. More investigation on potential factors that contribute to the increase of ASD diagnosis in children is warranted.

198 **143.198** Record-Based ASD Prevalence Estimates of 2004-2005 Birth Cohort in Taiwan

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Background: Â Previous studies in Taiwan reported the prevalence of autism spectrum disorder (ASD) among 3- to 17-year-olds was 2.1 per 1000 in 2011, with cumulative prevalence increased from 0.18 in 1996 to 2.87 in 2005 per 1000. However, these studies included children who were eligible for social assistance payments and retrospectively collected diagnostic information from clinical samples. The figures are therefore likely under-estimated the "true" prevalence. Prospective studies on ASD prevalence estimate, and the association between potential risk factors (e.g., prematurity, gender, geographical region, and urbanization) and ASD are limited.
Objectives: Â The objectives of the study are 1) to calculate the prevalent rate of ASD for children ages 0-8 in 2004-2005 birth cohorts; and 2) to examine the birth and demographic factors associated with the prevalence of ASD.
Methods: Â The study is a population-based cohort study with children born in Taiwan between 1 January 2004 and 31 December 2005, and had a claim documented in the National Health Insurance (NHI) database. NHI convers 96% of citizens of Taiwan. The prevalence of ASD was defined as those children who were born in the defined birth cohorts and have been diagnosed as ASD less than 8 years of age (before 2013). The denominator of calculating the prevalent rate was the total number of live births during 2004-2005. In addition, prematurity (gestational age < 37 weeks) and demographic characteristics (gender, region of residency, and urbanization) were also obtained from the database. Geographical distributions were classified into northern, central, southern, and eastern region. Urbanization was divided into urban and rural categories. Cox regression analysis was used to analyze the predictive factors for occurrence of ASD.
Results: The total number of children who were live birth in 2004-2005 were 424,299, and 6,086 of them were diagnosed as ASD between 2005 and 2013. The prevalent rate was 14.3 per 1,000 among 1- to 8-year-old children. Higher prevalent rates were shown in males (HR, 4.58; 95% CI, 3.28-6.38), premature babies (HR, 2.11; 95% CI, 1.80-2.47) and in those who lived in northern area compared to central area (HR, 2.21; 95% CI, 2.06-2.37); and in urban areas compared to rural areas (HR, 1.72; 95% CI, 1.62-1.83) (Table 1). Southern (HR, 1.20; 95% CI, 1.11-1.30), and eastern (HR, 1.26; 95% CI, 1.10-1.46) regions showed slightly higher prevalence of ASD than central area.
Conclusions: Using NHI claim data, our prevalence estimate for children under 8 years old in 2004/05 birth cohort is supported by reports from other countries. Factors of premature birth, male children, place of residence in northern and urban areas were associated with higher ASD prevalence. Our results indicated that the prevalence of ASD existed difference between urban and rural areas, and may be the consequence of uneven distribution of medical resources. Further researches may need to elaborate the association of distribution of medical care and ASD.

199 **143.199** Reliability and Validity of Self-Reported Home Environment in Autism Studies

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Background: Â Questionnaires can help advance research on environmental risk factors for autism when more detailed measurements are too expensive or not feasible, but only when these data are reliable and valid compared with gold standard measures.
Objectives: Â To compare maternal retrospective report of home characteristics that can be used to assess environmental exposures during pregnancy and until child's first birthday on the ELEAT (Early Life Exposure Assessment Tool) with prospectively collected responses, prenatal and postpartum home walkthrough visits, and public records in ASD-affected families.
Methods: Â Participants (n=120) from the MARBLES (Markers of Autism Risk in Babies-Learning Early Signs) prospective cohort study of high-risk younger siblings of children with autism completed a structured telephone interview during the 1st half of pregnancy (Environmental Exposures Questionnaire [EQ1]) and then again with the ELEAT, a shorter instrument administered 2 or more years postpartum. MARBLES Study also conducted a home walkthrough visit at the homes of participating families during mid-pregnancy and again at 6 months postpartum. Additional information about the home was obtained from public records (Zillow.com). Home characteristics compared with the EEQ included type of residence, tap water source, and whether the residence was near an agricultural field or golf course. Home square footage reported on ELEAT was compared with public records. Planned analyses for comparisons with home walkthroughs will include type of residence, year/decade the home was built, heat and air conditioning sources, and type of flooring. Reliability was assessed with Cohen's Kappa statistic (K); and validity with sensitivity (Se), specificity (Sp) and Youden's index (Y=Se+Sp-1) for each home characteristic for matched addresses from the index time period (conception until child's 1st birthday). Analyses were restricted to one address per family if more than one was reported during the index period.
Results: Â Ninety-two families were included in analyses comparing ELEAT responses with EQ1. Over 80% of families lived in a single family home. Mothers recalled the type of residence (single family home vs. multiplex/apartment/condo) with 100% accuracy (K=1.00). Agreement coefficients for water supply (public supply, private well) and ¼ mile proximity to agricultural field or golf course were fair (K=0.30 and 0.38, respectively). Eighty-one families were included in the home square footage analysis, compared with public records. Home area was divided into 4 categories: <1000 sq. ft., 1000-1999, 2000-3000, and >3000. However, very few families lived in homes <1000 or >3000 sq. ft. and we used collapsed categories <2000 and ≥2000 instead. Agreement was substantial (K=0.77).
Conclusions: Â Mothers of children with autism tended to recall information about the home they lived in during pregnancy and the child's first year reliably, and their responses to home size were highly valid. However responses on proximity of their homes to agricultural fields and golf courses, which can be used to assess likelihood for drift pesticide exposure, were not as reliable, suggesting other methods of drift pesticide exposure are likely needed.

200 **143.200** Risk of Epilepsy and Autism in Full- and Half-Siblings: A Population-Based Cohort Study

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Background: Epilepsy and autism spectrum disorder (ASD) frequently co-occur in the same individual and they may share common etiological factors. The sibling recurrence risk in both ASD and epilepsy is higher than expected which suggests that genes or environmental factors shared by family members play an important causal role in each disorder. However, no studies have previously evaluated the cross-disorder sibling risk for ASD and epilepsy.
Objectives: In a large population-based study, estimate the cross-disorder sibling risk for epilepsy and ASD in full and half-siblings of children with these conditions.
Methods: The study population comprised all Danish births, 1 January 1980 through 31 December 2006, and followed through 2012 (N=1,663,302) for reported ASD (N=17,145), epilepsy (N=22,531), death or immigration. All births were linked to parents and full and half siblings born in the birth cohort. The oldest child in a sibling set defined the exposure for all younger siblings. We used Cox regression to calculate the adjusted hazard ratio (aHR; risk for ASD or epilepsy in younger sibling given older sibling diagnosis) and the Kaplan-Meier method to calculate the cumulative incidence. Cox models adjusted for child's sex, parental age, and parental psychiatric or epilepsy history. Sensitivity analyses included analyses by birth year group, childhood autism specifically, epilepsy subtype, and considering intellectual disability in the younger sibling.
Results: Â The aHR of epilepsy in younger siblings increased by 70% (aHR = 1.70 (95% CI: 1.34-2.16%)) if the older sibling had ASD (64 events) compared with siblings where the older sibling did not; the aHR was 4.56 if the older sibling had both disorders. The cumulative incidence of epilepsy at 20 years of age was 2.54% (95% CI: 1.97-2.32%) if the older sibling had ASD and 1.63% (95% CI: 1.60-1.66%) if the older sibling did not. The aHR of ASD in younger siblings increased by 54% if the older sibling had epilepsy (159 events; aHR = 1.54 (95% CI: 1.32-1.80)) compared with siblings where the older sibling did not; the aHR was 4.44 if the older sibling had both disorders. The cumulative incidence of ASD at 20 years of age was 2.06% (95% CI: 1.84-2.32%) if the older sibling had epilepsy and 1.27% (95% CI: 1.25-1.29%) if the older sibling did not. Cross-disorder risks were increased in both full and half siblings. Similar results were found considering cross-disorder risk between epilepsy and autistic disorder; after excluding younger siblings with intellectual disability; and by birth year group of older sibling. ASD risks in the younger sibling by epilepsy subtype in the older sibling were similar to overall results. Risks for epilepsy subtype in the younger sibling from an older sibling with ASD were somewhat lower than overall results and not statistically significant.
Conclusions: The cross-disorder sibling risks of epilepsy and ASD suggest that genes or environmental factors shared by family members may play a causal role in the co-occurrence of ASD and epilepsy. The results may also inform developmental follow-up practices for healthcare professionals and parents.

201 **143.201** Screening for Autism Spectrum Disorder with the SCQ and SRS: Variation Across Demographic and Developmental Factors

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Background: The American Academy of Pediatrics recommends that all children be screened for autism spectrum disorder (ASD) at an early age. Early identification of children with ASD is critical for referral to early intervention services, which improve outcomes and reduce long term care costs. To date, the performance of ASD screeners has not been comprehensively examined across demographic, behavioral, and developmental characteristics in young children.
Objectives: To determine how two widely used ASD screeners, the Social Communication Questionnaire (SCQ) and Social Responsiveness Scale (SRS), perform across a variety of demographic and child characteristics.
Methods: Data for this analysis come from The Study to Explore Early Development. SCQ and SRS were collected by phone interview and paper questionnaire, respectively. All parents completed the Child Behavior Checklist (CBCL) and all children completed the Mullen Scales of Early Learning (MSEL). The Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview–Revised (ADI-R) were administered to children who screened above 10 on the SCQ, or if the clinician observed behaviors sufficient to warrant an ASD evaluation. Following the evaluation, the clinician scored his or her global impression that the child has ASD using the Ohio State University Autism Rating Scale-4 (OARS-4), which served as our gold standard for all calculations. Additional demographic data were collected via a standardized parent interview. Sensitivity and specificity were calculated for the SCQ using cut-offs of 11, 13 and 15, and the SRS using a T score cut-off of 60 relative to the OARS-4. Sensitivity and specificity were then stratified by demographics (maternal race, ethnicity and education; household income; and MSEL and CBCL subscales.
Results: This analysis included 2317 children with a completed developmental evaluation, and OARS, CBCL, SCQ, and SRS assessments; 616 had ASD and 1701 were non-ASD, with 852 identified with developmental disability from educational and clinical settings and 849 population controls identified from state vital records. There was a significant difference in proportion of children with ASD and non-ASD who had below average cognitive functioning (74% versus 30% respectively). Overall, sensitivity and specificity were acceptable for the SCQ with a cut-off of 11 (0.87 and 0.81) and 13 (0.75 and 0.86), and for the SRS (0.85 and 0.77, respectively); however, specificity was considerably lower for African American and Hispanic mothers. Both the SCQ and SRS became less specific and more sensitive as maternal education and household income decreased. Specificity also decreased by as much as 50% when the child had below average scores on the MSEL or borderline to clinical scores on the CBCL.
Conclusions: These findings suggest that the SCQ and SRS cannot accurately differentiate many children with developmental delay from ASD within a diverse sample of children. Screening individuals from minority and lower socioeconomic backgrounds increases false positive rates. Refining these screeners to be more effective regardless of the child's behavioral presentation and across cultures could help reduce the impact of false positives. When used clinically, additional testing with standardized instruments, such as the ADI-R and ADOS, is needed to inform the differential diagnosis.

202 **143.202** Self-Reported Pregnancy Exposures and Placental DNA Methylation in the Marbles Prospective Autism Sibling Study

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Background:
Human placenta is a fetal-derived tissue that offers a unique sample of epigenetic and environmental exposures present in utero.
Objectives:
Â In the MARBLES prospective pregnancy study of high-risk younger siblings of children with autism spectrum disorder (ASD), pregnancy and environmental factors collected by maternal interviews were examined as predictors of placental DNA methylation, including partially methylated domains, an embryonic feature of the placental methylome.
Methods:
DNA methylation data from MethylC-seq analysis of 47 placentas of children clinically diagnosed at 3 years with ASD or typical development (TD) using standardized assessments were examined in relation to: child's gestational age, birthweight, and diagnosis; maternal pre-pregnancy body mass index, smoking, education, parity, height, prenatal vitamin and folate intake; home ownership; pesticides professionally applied to lawns or gardens or inside homes, pet flea/tick pouches, collars, or soaps/shampoos used in the 3 months prior to or during pregnancy. Sequencing run, order, and coverage, and child race and sex were considered as potential confounders. Akaike information criterion was used to select the most parsimonious among candidate models. Final prediction models used sandwich estimators to produce homoscadisticity-robust estimates of the 95% confidence interval (CI) and p-values controlled the false discovery rate (FDR) at 5%.
Results:
The strongest, most robust associations were between pesticides professionally applied outside the home and higher average methylation over partially methylated domains (0.45 (95% CI: 0.17, 0.72), P=0.03) and a reduced proportion of the genome in partially methylated domains (-0.42 (95% CI: -0.67, -0.17), P=0.03).
Conclusions:
Pesticide exposures could alter placental DNA methylation more than other factors.

203 **143.203** Study on Prevalence of Autism in Rural Bangladesh

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Background:
In Bangladesh, autism has already been identified as burden of diseases and it has been assumed that the magnitude is high and majority cases, is undetermined. Especially in the rural settings, Autism has been found as neglected disease. However, there was no epidemiological strong evidence on autism prevalence in rural Bangladesh. In the Institute of Pediatric Neurodisorder& Autism in Children, at Bangabandhu Sheikh Mujib Medical University data shown that higher rate of children with autism at urban settings are seeking treatment from the facility.
Objectives:
To observed the prevalence of Autism Spectrum Disorder in rural community of Bangladesh.
Methods: A cross sectional study has been performed in where quantitative data was collected from the household level by door to door visit in rural community of Bangladesh. A four stage diagnosis process was applied to confirm autism. This study findings shown that among 5286 children of 18moths to 36 months aged group in one upazilas (six unions).
Results:
04 cases were found with autism spectrum disorder (ASD). Prevalence of the ASD in rural community was found 0.075%. Among the four ASD cases three were boys and one was girl and age range is between 20- 30 months.
Conclusions:
The findings also shown the parents in the rural community still not much aware about the disease, mostly treatment in government facilities or at local level. However, children were not received treatment from specialized facilities where ASD treatment/ counseling are in practice. Social stigma and barriers are also found as one of the key challenge in rural Bangladesh.

204 **143.204** Testosterone and Steroids in Meconium: Differences By Sex of the Offspring

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Background: Prenatal metabolism exerts profound effects on development. The first stool of the newborn, meconium, provides a window into the prenatal metabolic environment.
Objectives: The objective of this study was to examine the feasibility of meconium as a novel matrix to quantify prenatal steroid levels. We quantified parameters of analytical interest regarding the use of meconium, including sample stability. We hypothesized that meconium steroid content would differ by sex, prompting analysis of meconium to test effects of prenatal steroid metabolism.
Methods: Meconium from 193 newborns enrolled in the Early Autism Risk Longitudinal Investigation (EARLI) study, including 107 males, and 86 females, were analyzed by stable isotope dilution-liquid chromatography-high resolution mass spectrometry (ID-LC-HRMS) while blinded to identity for testosterone (T), androstenedione (AD), and dehydroepiandrosterone (DHEA). Steroids levels were compared by sex, and investigations of potential trends resulting from sample storage or processing was conducted.
Results: The unconjugated steroid content of meconium in ng/g (mean, standard deviation) was for males: T (2.67, 8.99), AD (20.01, 28.12), DHEA (13.96, 23.57) and for females: T (0.82, 1.63), AD (22.32, 24.38), DHEA (21.06, 43.49). T was higher in meconium from males (p = 0.0333), and DHEA was higher in meconium from females (p = 0.0202). 6 female and 3 male T values were below the limit of detection. No extreme variability in hydration or trend in steroid levels by storage time was detected.
Conclusions: Sexually dimorphic levels of hormones may reflect gestational differentiation, and future studies should consider meconium analysis.

205 **143.205** The ATN Longitudinal Study: Changes in Behavior, Sleep and Quality of Life over Time

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Background:
Longitudinal data for autism spectrum disorders (ASD) are limited. The Autism Speaks Autism Treatment Network (ATN) Longitudinal Study tracks behavioral, functional and medical data on youth with ASD to better understand the natural course of ASD and their comorbid symptoms and behaviors. Objectives:
To describe the trajectory of behavioral, functional, and medical symptoms of ASD over 3-4 years, and the associations across these symptom domains in a large cohort of youth with ASD.
Methods:
A random sample of subjects originally enrolled in the ATN Registry between 2011-13 were contacted at each of 14 ATN sites to participate in follow-up behavioral and medical assessments on measures collected at baseline enrollment. We report here results from the initial follow-up visit completed in 2015-2016.
Results:
Of 1275 subjects contacted, 575 consented to participate. Consented subjects were 83% male; 81% White, 7% AA, 5% Asian; 92% Non-Hispanic. Age at baseline was 5.9 years ± 3.2 (mean ± SD, range 4.5 to 20.9), and follow-up interval was 3.7 years ± 0.6. There were no differences in sex, race, or ethnicity between consenters & non-consenters. ADOS severity, Vineland Adaptive Behavior Scales (VABS), sleep, GI and seizure disorders were the same in both groups, while non-consenters scored worse on Children's Sleep Habits Questionnaire (CSHQ), Child Behavior Checklist ADHD scale (CBCL-ADHD), with a trend toward worse scores on the Aberrant Behavior Checklist (ABC) Hyperactivity scale and Pediatric Quality of Life (Peds QL). From baseline to follow-up, the CBCL Total Problems t-scores improved 2.7 points and the ABC Irritability scale improved 2.5 points. Improvements on the CBCL and ABC were greatest for those with higher baseline scores (Figures 1 and 2). Scores on the PedsQL improved 1.8 points over the same interval. Scores on the CSHQ improved a mean of 0.7 points with the greatest improvement seen in those with higher scores at baseline.
Conclusions:
While only 45% of targeted subjects completed a follow-up visit, the sample enrolled appears to be largely free of bias and represents one of the largest longitudinal cohorts of youth with ASD reported. The longitudinal changes seen are largely congruent with previous reports in smaller cohorts. Behavioral problems as measured by the CBCL Total Problems scale and the ABC-Irritability scale show modest improvement over the 3-4 year interval. These findings may overestimate long-term trends as the non-consenting group demonstrated slightly worse behavioral problems at baseline. Overall quality of life as measured by the PedsQL and parent reported sleep problems measured by the CSHQ improved minimally on average. Future analyses will examine relationships between measures, changes in medical conditions, and the relationship between medical conditions and behavioral and functional outcomes.

206 **143.206** The Association of Maternal Lipid Levels and Autism Spectrum Disorder Risk.

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Background: Maternal obesity and gestational diabetes are conditions of increasing concern among pregnant women in the United States. Emerging evidence also links these metabolic dysregulations with risk of autism spectrum disorder (ASD), which affects more than 1% of children in the United States. Recent research identified maternal obesity and gestational diabetes as ASD risk factors. However, little is known about how the biological indicators of metabolic dysregulations are associated with ASD risk.
Objectives: We measured maternal serum lipid levels to examine the association with ASD risk stratified by maternal BMI categories.
Methods: We performed a nested case-control study drawing on the Boston Birth Cohort (BBC), an urban minority prospective birth cohort. BBC children with at least 1 inpatient, outpatient, or emergency room visit to the Boston Medical Center between 2003 and 2015 were eligible for inclusion in our analysis. Electronic medical record ICD-9-CM diagnosis codes were used to identify ASD cases and neurotypical controls among BBC participants. Maternal non-fasting serum lipids (triglyceride (TG), high density lipoprotein (HDL), total cholesterol, and calculated low density lipoprotein (LDL)) were obtained from blood samples collected after delivery. Logistic regression was used to assess the association between ASD risk and lipid measurement. Maternal lipid quantiles were use to examine non-linear associations. Models were also stratified by maternal pre-pregnancy BMI groups (normal, overweight and obese) to assess interaction.
Results: A total of 99 children with ASD and 698 neurotypical children were identified among mother-child dyads with lipid measurements. There was no association between maternal total cholesterol, HDL and TG with ASD risk. However maternal LDL level was associated with increased ASD risk in both the lowest (<92 mg/dL; OR 2.4 [CI: 1.3-4.4]) and highest (>250 mg/dL; OR 1.9 [CI: 1.1-3.6]) tertiles compared to the middle tertile (92-250 mg/dL) after adjusting for gestational age, sex, maternal age, education and birthweight. When stratified by maternal BMI groups, maternal LDL association with ASD risk did not persist in the normal and overweight groups but was still seen among obese mothers. Interestingly a similar U-shaped pattern of ASD risk was observed among children born to obese mothers (Lowest tertile OR 5.2 [CI: 1.4-25.2], Highest tertile OR 5.3 [CI: 1.4-26.9]).
Conclusions: Our study shows that both low and high maternal LDL levels are associated with ASD risk compare to the middle LDL range, particularly among obese mothers. Optimal maternal lipid levels during pregnancy are not well established and more study is needed to better understand the role of maternal LDL and ASD risk.

207 **143.207** The Influence of Clinical Judgment in a Record-Review Surveillance System on Autism Spectrum Disorder Prevalence Estimates

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Background: Symptoms of autism spectrum disorder (ASD) overlap with other conditions in early childhood (e.g., attention deficit hyperactivity disorder). Differential diagnosis by a clinician is important to distinguish ASD from other disorders. One way to estimate ASD prevalence while mitigating resources needed for in-person evaluations is to have clinicians apply professional judgment to abstracted service (educational and health) records to determine case status. Clinical judgment applied to service records may exclude children who meet a standardized definition of ASD, but have symptoms that are better accounted for by another disorder.
Objectives: The objectives of this analysis were to (1) identify the number of children in a population-based surveillance system who met a standardized definition of ASD, but were disqualified as having ASD by a clinician who reviewed service records, (2) assess associations between ASD status determined by a clinician who reviewed the service records and the clinician who examined the child and authored the service record, and (3) estimate the change in ASD prevalence if children who were disqualified by a clinician who reviewed service records were included in ASD prevalence estimates.
Methods: Participants were children who met the Autism and Developmental Disabilities Monitoring Network (ADDM) case definition for ASD in surveillance year 2012. Education and health records were abstracted by project personnel and sent to clinicians for comprehensive review. Clinicians applied a standardized coding scheme based on DSM-IV-TR criteria to abstracted information to determine ASD case status. A child was “disqualified” if he or she met standardized coding criteria for ASD, but the clinician felt that symptoms were better accounted for by another disorder or any other reason. Children who were disqualified were not included in ASD prevalence estimates.
Results: 6,112 children met ADDM coding criteria for ASD; 5,063 (83%) were not disqualified and 1,049 (17%) were disqualified after record review. Logistic regression found that children who were disqualified were less likely than children who were not disqualified to have 1) a diagnosis of autistic disorder, pervasive developmental disorder – not otherwise specified, or Asperger disorder (9.1% versus 73.8%); 2) a special education classification of autism (1.0% versus 23.9%); and ASD characteristics noted in service records (16% versus 67.1%). However, children who were disqualified were more likely than children who were not disqualified to have ASD excluded by the clinician who evaluated the child and authored the service record (28.4% versus 10.0%). ASD prevalence increased from 14.6 per 1,000 to 17.6 per 1,000 when children who were disqualified were included in prevalence estimates.
Conclusions: The estimated prevalence of ASD is higher when clinical judgment is not applied to surveillance case definitions. More children who do not have ASD noted in service records – and who do have ASD excluded by a clinician who evaluated the child – are omitted from surveillance counts when clinicians disqualify children based on professional judgment. More research is needed to determine the influence of clinical judgment on ASD prevalence estimates, and the clinical characteristics that are associated with disqualification of ASD surveillance case status.

208 **143.208** The Negev Hospital-University-Based (HUB) Database of Autism

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Background:
In the last decade, research into the etiologies of autism is shifting from small-scale studies often focusing on one or several biological/clinical measures in a small sample, to more extensive studies that examine multiple types of data in larger cohorts. Nevertheless, many of these studies have relatively limited pre-diagnostic data, and usually do not collect sufficient follow-up data that enables connecting the etiological dots from risk factors through biological mechanisms to precise phenotypic manifestations.
Objectives:
We have established a hospital-university-based (HUB) database of autism at the Soroka University Medical Center (SUMC) and Ben-Gurion University (BGU) in the Negev. This database contains a wide variety of unique clinical and behavioral information regarding each participating child and his/her family members.
Methods:
Children who are referred to SUMC with suspected social communication difficulties go through a rigorous clinical assessment that includes a comprehensive intake interview regarding the clinical and sociodemographic background of the diagnosed child, cognitive evaluation by either the Bayley-III or the WPPSI-III test and assessment by ADOS-2. Autism diagnosis is determined by a pediatric psychiatrist or a pediatric neurologist according to DSM-V criteria. Parents or the legal guardian of all referred children are asked to enroll in the study and sign a consent form. Children with a positive diagnosis of autism return to the clinic for follow-up visits every 6 to 12 months until the age six. During these visits, their diagnosis is re-evaluated and additional data are collected through other ongoing studies (e.g. genetics, sleep and sensory questionnaires, overnight EEG exams, and eye-tracking experiments). All these data are organized and stored in a designated secured computerized database.
Results:
During the first eighteen months of the study, 296 children were referred to SUMC with suspected social communication difficulties. Autism diagnosis was confirmed in 188 of these children (63.5%), and 133 of these (70.4%) were successfully recruited to our study. Interestingly, the rate of positive autism diagnoses was significantly higher among Jewish children than among Bedouin children (68.3% vs 51.3%; P = 0.0077). Significant ethnic differences (P<0.05) were also seen in mother’s age at birth (Bedouin mothers were 5-years younger), ADOS module, and cognitive test utilization (suggesting more language impairments among Bedouins at time of diagnosis), and cognitive level (Bedouin had lower cognitive scores). Other unique characteristics of our cohort include: complete birth records for >90% of the children; a high frequency of consanguineous families (especially of Bedouin origin); and multiple follow-up meetings with participating families that facilitate recruitment to additional studies.
Conclusions:
The Negev hospital-university-based (HUB) database of autism contains a wide variety of demographic, clinical and behavioral measures that are collected both retrospectively and prospectively from a population with unique ethnic composition. Thus, it comprises a remarkably rich resource to study different aspects of autism.

209 **143.209** The Parental Stress and Externalizing Behavior in Children with Autism Spectrum Disorder in Oman: A Case-Control Study

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Background:
Parental stress has been widely documented in the literature on children with developmental disorders such as autism spectrum disorder (ASD). These studies have demonstrated a linear relationship between co-occurring cognitive, emotional and behavior problems in children with ASD and parental stress. With the rising tide of ASD in emerging economies such as Oman, studies relevant for psychosocial issues relevant to ASD are warranted.
Objectives:
This study aims to compare the performance indices of externalizing behavior in children with ASD as solicited by the Strengths and Difficulties Questionnaire (SDQ), .the parental reactivity as tapped by Parental Stress Scale (PSC) as well socio-demographic factors contribute to parental stress
Methods:
A case control study has been conducted on 122 ASD children, 81 intellectual disabilities, children and 90 typically developing children and their parents. Children with ASD were selected from the Sultan Qaboos University Hospital (SQUH) by convenience sampling method whereas control groups were recruited by the same method from social centers and schools. Parenting stress was tapped into by ***Parental Stress Scale*** (PSC) while co-occurring cognitive, emotional and behavior functioning was evaluated using ***the Strengths and Difficulties Questionnaire*** (SDQ).
Results:
,8 .16=is greater than the total mean score of intellectual disabilities are typically developed children (m (20=The total mean score of SDQ for children with ASD (m The study found out a linear association between behavior problems in children with ASD and parental stress, in other words, whenever behavior problems .(3 .13=m .48=The mean score of PSC for parents who caring for children with ASD (m .(0.001 =p-value ,54 .0=^{2}in children with ASD increase, parental stress also increases (r Mothers of children with ASD experienced stress more than fathers. .(35=and TD (m (3 .36=was higher than the mean score of parents with children with ID (m (4 .There was also trend on trajectory of socio-economic status on parental stress
Conclusions:
The parents of children with ASD are marked with higher indices of stress, a feat that has been observed from elsewhere. Secondly, externalizing behaviors are more common in children with ASD than the control. The mothers are more likely to experience higher stress compared to fathers. Moreover, income appears to play an important role in such trajectories. Concerted efforts are needed to introduce mechanisms to help parents with ASD in Oman in coping with the challenge of nurturing .children with ASD

210 **143.210** The Prevalence of Autism Spectrum Disorder in School Aged Children: Population Based Screening and Direct Assessment

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Background: The South Carolina Children's Educational Surveillance Study (SUCCESS) evaluated the prevalence of autism spectrum disorder (ASD).
Objectives: To determine prevalence of ASD in school-aged children born in 2004 using population-based screening and direct assessment.
Methods: Â Children born in 2004 and living in a contiguous geographic region (census derived n=8780) were screened for ASD using the Social Communication Questionnaire. The demographics of the catchment area for the target age group are 57% Non-Hispanic White, 33% Non-Hispanic Black, 8% Hispanic, and 2% other. Screening was conducted in partnership with 123/127 private and public elementary schools. Partnerships were also established with 25 home-school associations and three virtual schools in the area. All children at risk for ASD, as well as a subset of those falling below the threshold for risk, were invited to participate in a developmental assessment to determine ASD case status. Diagnostic assessment procedures included parent interview, parent and teacher behavior checklists, IQ and adaptive measures, and the Autism Diagnostic Observation Schedule, Second Edition. Clinical diagnoses were assigned by doctoral level clinicians, and were based on lifetime history of ASD symptoms. Prevalence estimates with 95% CI were calculated based on the NCHS vintage 2014 census population estimates. To account for the complex multi-phase design, multiple sampling weights with raking procedures were computed to account for the differentials in the probability of selection between strata, differences in non-response, and sampling frame adjustments in the final weighted estimate.
Results: Approximately 48% of eligible children participated in the screening process (n=4185). Of children with complete screening data (n=3,698), 7.4% screened positive for ASD risk, and 23% fell in a sub-threshold range for ASD risk. Of eligible children invited for a diagnostic assessment (n=704), 41.5% completed this assessment (n =292). ASD prevalence in this sample is 3.62%. Males were more likely to have ASD than females (6.77:1). ASD prevalence was higher among white children (3.92%) than black children (2.52%). Among those diagnosed, 21% had cognitive functioning falling in the Intellectually Disabled range, and 70% had delays in adaptive skill development (Vineland ABC<85). The majority of children meeting criteria for ASD (36/52; 69%) had received a formal clinical ASD diagnosis prior to entering the study. Of the 16 children newly identified via participation in the study, 14 had a prior neurodevelopmental/behavioral diagnosis such as ADHD, anxiety, language delay, etc. Six children (6/52; 12%) had a clear developmental history of ASD but did not display clinically significant symptoms at the time of participation in this study.
Conclusions: ASD prevalence in this study was substantially higher than has been previously reported by studies using records-based or administrative count methods to ascertain prevalence. Our study also revealed substantial functional impairment in the ASD group during the later elementary school years. Results suggest that some individuals with ASD may not be formally identified as such and may not be receiving the appropriate supports. However, 12% with a history of ASD no longer had significant ASD-related symptoms, providing further support for the potential for optimal outcomes in some individuals.

211 **143.211** The Use of Psychoactive and Complementary Alternative Medicine (CAM) in Autism Spectrum Disorder (ASD) in Minors in the Province of Antwerp, Belgium

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Background: Â To date, particularly in European countries, relatively little is known regarding the prevalence of medication use for treatment of individuals with ASD. Previous international studies suggested that that an ever-increasing number of patients with ASD use at least one psychoactive drug. Even studies in the nineties suggested that frequent use of psychoactive medication was widespread although evidence for this assumption was limited at the time.
Objectives: The main aim of this study was to gauge the use of psychoactive medication and complementary and alternative medicine (CAM) in the province of Antwerp, Belgium. A second aim was to investigate the relationship between medication use and 'predisposing', 'enabling', and 'need' factors included in the Behavioral Model of Health Service Use (Andersen, 2008).
Methods: Respondents, consisting of parents of children aged 0-17 years diagnosed with ASD, were recruited in the province of Antwerp, Belgium. All completed a Dutch translation of the Survey of Medications in persons with autism (Aman et al., 1995).
Results: Results showed that 42.6% of the children (n=263) were reported to use at least one psychoactive drug. Over 12.2% were reported to use more than one drug. ADHD medication was most frequently reported (31.6%), followed by antipsychotics (16.7%). Some form of CAM was used by 14%. There was a positive relationship between the use of medication and psychiatric comorbidity and/or epilepsy, severity of autism and housing arrangements.
Conclusions: Compared to North American studies there was a relatively low use of antipsychotics, antidepressants, mood stabilizers and sedatives. Our findings do not provide evidence of overmedication and suggest that the use of medication in ASD in at least the studied province in Belgium is in accordance with current clinical guidelines.

212 **143.212** Understanding Prevalence and Kindergarten Behavioural Profiles of Children with Autism Spectrum Disorder

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Background: Health disorder such as Autism Spectrum Disorder (ASD) in early childhood can impact the developmental trajectory of the child. Early identification can facilitate access to information and resources that will assist the family and child to achieve the most optimal developmental outcomes. Identification of behavioural profiles common to children with ASD in preschool and kindergarten can provide helpful information for educational professionals in managing classrooms and promote inclusion. Building on our previous work investigating kindergarten behavioural profiles of children who were later diagnosed with Autism Spectrum Disorder, we have linked the data reported by teachers in kindergarten on child's diagnosis and an assessment of child development in five domains with administrative data. In this study we are using the data from one Canadian province, Manitoba, to explore prevalence on ASD in kindergarten, teachers' knowledge (determined by linking), and behaviour of those children.
Objectives: This study aims to 1) determine the concordance of EDI and administrative data when identifying children with ASD in Manitoba, and 2) examine differences in behavioural profiles of children in five developmental domains by child's diagnosis and teacher's knowledge. We expect that there will be no difference in teachers' ratings of children with the confirmed (through linkage) ASD diagnosis between those for whom teacher reported the diagnosis and for whom s/he did not.
Methods: The Early Development Instrument (EDI) has been used in Manitoba since 2005 and has included the option to identify children that fall on the autism spectrum since 2011. Combining this population-level data with health and educational administrative data provides a powerful opportunity to explore the identification of ASD in Manitoba.
EDI data including indication of ASD were collected in Manitoba in academic years 2010-2011 and 2012-2013. Health and education administrative data have been collected on an ongoing basis in Manitoba and are housed through the Manitoba Centre for Health Policy (MCHP). These data include, but are not limited to, prescription information, hospitalization records, and codes for diagnoses.
Results: Results show good concordance between the administrative and EDI data. The administrative data show an overall prevalence rate of ASD in kindergarten at 0.9% (n=229) and the EDI data estimates ASD prevalence at 0.8% (n=191). Fifty-eight percent (n=177) of ASD cases were identified by both the administrative data and the EDI, 37% (n=112) of ASD cases were identified prior to kindergarten only by the administrative data, and 5% (n=14) of cases were identified only by the EDI data. Comparison of behavioural profiles between the groups is ongoing.
Conclusions: The EDI and administrative data in Manitoba show good concordance in identifying children with ASD at school entry. Our investigation takes into consideration details such as the age of first diagnosis and post-kindergarten diagnoses. We also examine associated child vulnerability at school entry as determined by the EDI, which has implications for practices, procedures, and policy surrounding identification and assistance of children with ASD in the school system.

213 **143.213** Using Health, Education and Research Administrative Databases to Better Understand Autism Prevalence in Australia

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Background:
Autism Spectrum Disorder (ASD) prevalence has been increasing worldwide. In Australia varied prevalence estimates have been reported from under 1% to more recently 2.5%. Exploring different administrative and research databases with varied criteria for the classification of ASD may provide insight into factors influencing prevalence.
Objectives:
To explore the prevalence of ASD in Australia using research and administrative databases from health, education and research systems using data collected in 2014.
Methods:
Secondary analyses of health, education and research databases were performed. The Victorian Department of Education and Training program for students with disability data was used to explore ASD prevalence in school aged children (5-18 years). To be classified under the ASD category, in addition to a confirmed medical diagnosis of ASD, children required a severe language impairment. Health data from the Australian Medicare Benefits Scheme items used by paediatricians and psychiatrists for the diagnosis of children with ASD aged 0-12 years was also explored. This required a paediatrician or child psychiatrist confirmed ASD diagnosis. Secondary analysis of the Longitudinal Study of Australian Children (LSAC) were also performed. LSAC is a nationally representative sample of Australian children. Parent reported ASD diagnoses from the Birth cohort (born in 2003/2004) collected in 2014 when the children were aged 10-11 years were used. Medicare ASD diagnostic items linked to LSAC data were also explored.
Results:
Education data showed the prevalence of ASD in the Victorian state school aged population (5-18 years) was 0.87% (95% CI 0.84-0.89). Health data using Medicare diagnostic items showed a preliminary prevalence of 2.81% (95% CI 2.80-2.83) in children aged 0-12 years. The parent reported prevalence of ASD diagnoses in 2014 using LSAC research data from the Birth cohort was 3.86% (95% CI 3.17-4.55) in 10-11 year old children. Medicare linked ASD diagnostic items in the LSAC Birth cohort were lower than parent report at 1.73% (95% CI 1.36-2.21).
Conclusions: No one administrative source will present a complete picture of service need and administrative sources are often thought to underestimate true prevalence. Large differences in prevalence depending on the data source were not expected nor were higher prevalence estimates than have been reported in other study designs and settings. Factors driving high estimates and differences need to be understood, as does appropriateness of service access.

214 **143.214** Validation of the Utah Registry of Autism and Developmental Disabilities: A State-Wide Registry for Autism Spectrum Disorder

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Background: State-based autism spectrum disorder (ASD) registries are becoming more common in the U.S. and provide an important public health surveillance service. Eight state-level ASD registries currently exist including the Utah Registry of Autism and Developmental Disabilities (URADD). URADD, established in 2002, tracks changes in ASD prevalence in Utah, investigates ASD epidemiology, informs public policy, and supports ASD-related service planning. The multiple uses of ASD registry data necessitate validation of information acquired by these registries, especially ASD case status.
Objectives: 1) Validate URADD's ascertainment of children with ASD against the Utah Autism and Developmental Disabilities Monitoring (UT-ADDM) project's ascertainment of children with ASD. 2) Determine the impact of imposing a more stringent definition of ASD on URADD prevalence estimates, sensitivity, and specificity.
Methods: URADD uses two ascertainment methods. The first is a passive surveillance system in which individuals with ASD are identified by birth cohort based on a community medical ASD diagnosis and/or autism special education eligibility (URADD method). Second, URADD previously participated in the CDC's ADDM Network in surveillance years (SY) 2002, 2008, 2010, and 2012. ADDM uses a retrospective record review approach to identify children who meet ASD case definition based on DSM-IV-TR criteria (UT-ADDM method). For this study, eight-year-old children identified with ASD, residing in the three county UT-ADDM surveillance area in SY2010 or SY2012 were categorized by ascertainment method: URADD, UT-ADDM, or both. ASD prevalence was estimated by ascertainment method and compared using a chi-square test. The sensitivity and specificity of URADD ASD case status was estimated using UT-ADDM as the gold standard. A more stringent URADD definition was subsequently imposed by limiting ascertainment to children with ≥ 2 medical ASD diagnoses and/or an autism special education eligibility.Â URADD-based ASD prevalence, sensitivity, and specificity analyses were subsequently repeated.
Results: Â Collectively, 872 and 1141 eight-year-old children were identified with ASD by UT-ADDM and URADD, respectively for SYs 2010/2012. 74% of eight-year-old children identified with ASD in SYs 2010/2010 were ascertained by both UT-ADDM and URADD (N=647). URADD's ASD prevalence estimate (23/1,000 eight-year-old children (95% Confidence Interval (CI)): 22.1-24.8) was statistically significantly higher than UT-ADDM's (18/1,000 eight-year-old children (95% CI: 16.8-19.1); p-value < 0.0001). Sensitivity and specificity of URADD case ascertainment was 81.7% and 96.4%, respectively. After removing the 263 cases ascertained by URADD based on a single medical diagnosis, URADD's prevalence was reduced to 14.0/1,000 (95% CI: 12.9-14.9) eight-year-old children, and sensitivity and specificity of URADD versus UT-ADDM changed to 58.5% and 98.6%, respectively.
Conclusions: Â URADD's high sensitivity and specificity compared with UT-ADDM validates URADD's community-based approach to ASD case ascertainment. URADD's approach results in higher ASD prevalence estimates than the UT-ADDM method suggesting that the URADD approach may be more susceptible to identifying persons who are false-positive for ASD. However, imposing a stricter definition of ASD on URADD resulted in a marked decrease in sensitivity and only a minimal increase in specificity. From a public health perspective, URADD's capacity to conduct complete population-wide ASD ascertainment outweighs the risk of mis-classifying a small proportion of unaffected persons.

Poster Session
144 - Family Issues and Stakeholder Experiences I
12:00 PM - 1:40 PM - Golden Gate Ballroom

215 **144.215** Oral Health and Dental Care Among Children with and without an Autism Spectrum Disorder in Australia: A Comparative Study

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Background: Impairments associated with autism spectrum disorders (ASD) may limit children with ASD ability to engage in self-care and healthcare. Oral health is empirically linked with general health whilst dental health-care is fundamentally required across the life-course. Health behaviours are usually formed during the childhood years. However, little is known about oral health behaviours of children with ASD in the world and there are no published dental health reports for Australian children with ASD.
Objectives:
This study aimed to better understand oral and dental health of children with ASD in Australia. The objectives were:

1. To examine dental health status and oral hygiene practices in children with ASD, in comparison with the general paediatric population.
2. To identify oral health factors that may impact on dental health status of children with ASD.
3. To examine dental visits experience of children with ASD.
4. To identify barriers to dental care at home and at the dentist.

Methods:
An online survey asked parents about their child with ASD oral health status, oral hygiene practices and barriers to dental care. The survey data of 5-14 year olds with ASD (n = 57) was compared with the 2012-2014 Australian National Child Oral Health Survey (NCOHS) (n = 24, 664) on a range of socio-demographics and dental health factors. The NCOHS questionnaire data was parent-reported and child oral clinical examinations were performed by dental practitioners.
Results:
Children with ASD had a higher rate of deciduous dental decay and permanent filled teeth compared with NCOHS children ($p < .001$) (Figure 1). Children with ASD were more likely to visit the dentist for a dental problem or when in pain compared with NCOHS children ($p < .001$). Children with ASD were more likely to be older than NCOHS children at their first dental visit ($p < .001$) (Table 1). Nearly 20% of children with ASD had a negative experience during their last dental visit. Sixteen percent of children with ASD had conscious sedation or general anaesthesia for routine preventive treatments. Children with ASD had moderate-to-severe levels of oral (78.1%), taste (82.9%), light (72.3%) and sound (84.1%) sensitivities. Most parents (67.7%) of children with ASD had difficulties with children's oral care. Over 40% of parents had little/quite a bit of difficulty locating a dentist willing to provide dental care for their child with ASD.
Conclusions:
This study provides information about oral and dental health problems among children with ASD, in Australia. It also adds value to the emerging worldwide evidence about oral health needs and barriers to dental care for children with ASD. Findings showed that children with ASD have more dental decay compared with the general paediatric population. This study highlights difficulties with oral care for children with ASD. Sensory sensitivities pose challenges to effective dental hygiene and dental care visits. This study has research and clinical implications focused on preventive strategies that can assist both, parents and children with ASD to overcome dental care problems in an effort to prevent or reduce dental disease.

216 **144.216** Parent Concerns and Screen-Based Media: Teens with ASD and Typically-Developing Peers

C. A. Cohen[1] *and A. R. Marvin*[2]*, (1)Kennedy Krieger Institute, Baltimore, MD, (2)Painter Bldg 1st Fl, Kennedy Krieger Institute, Baltimore, MD*

Background:
With the ubiquitous use of technology among teens with autism spectrum disorder (ASD), their gaming and video viewing habits have become an important concern to parents. Given that restricted, repetitive patterns of behavior, interests, and activities are diagnostic of ASD, researchers are beginning to investigate the excessive and inappropriate use of screen-based media by people with ASD.
Objectives:

- To understand parents' concerns with the video and gaming behaviors of their teens with ASD
- To determine whether parents' concerns are different for teens with ASD and typically-developing (TD) teens

Methods:
An anonymous 80-question survey was administered online to parents/guardians of children ages 13-17 living in the US with and without ASD. Participants were recruited using the Interactive Autism Network (IAN) and social media. The survey ran in October and November 2015.
348 survey instances were completed: ASD=264 (76%); TD=84(24%). Male-to-female gender ratios for TD (1:1) and ASD (5.87:1) were in the expected range.
Results:
Three groups were used for analysis: ASD with normal-or-above intellectual ability (ASD-Average; n=131); ASD with lower-than-normal intellectual ability (ASD-Low; n=133); and typically-developing teens (TD; n=84). No TD teens were attributed with lower-than-normal intellectual ability. Logistic regression was used to compare parental concern across groups, controlling for child's age, gender, race, and ethnicity.
Video-viewing behavior. Nearly all teens in our sample viewed videos. The ASD-Average teens' viewing habits were of the greatest concern (58.7%) as compared to ASD-Low (44.6%) and TD (34.5%). The difference between the groups was statistically significant ($\chi^2(6)=13.88$, $p=.031$).
Parents were asked to describe their main concerns. A thematic content analysis revealed the following themes for the ASD groups, in order of frequency: inappropriate/violent content; excessive viewing time; need for parental controls/monitoring; and safety.
Gaming behavior. A majority of teens were gaming, with the ASD-Average group gaming significantly more than the other groups at 91% ($\chi^2(2)=7.10$, $p=.029$). Many parents expressed concern; however, the logistical regression model demonstrated that gender was the key factor, with parents of boys being far more concerned than parents of girls across all groups ($\chi^2(6)=18.61$, $p=.005$; gender male, $p=.005$).
A thematic content analysis of parental concerns revealed the following themes for the ASD groups, in order of frequency: excessive time spent gaming; bad content/content that overexcites (including sexual, profane, inane, and violent); problems with other gamers in social gaming; frustration with gameplay; safety; and behavioral issues, including oppositional behaviors, violent behavioral, and meltdowns.
Conclusions:
Parents of teens with ASD were worried about their teens' judgment and the excessive amount of time spent watching videos and playing games to the exclusion of other activities. Given recent research on the relationship between the excessive use of screen-based media and issues including oppositional behavior and sleep problems, more research needs to be done to clarify these associations so that interventions can be developed.

217 **144.217** Parent Experiences of Raising an Adolescent with Autism Spectrum Disorder

H. S. Ho[1] *and A. Perry*[2]*, (1)Psychology, York University, Toronto, ON, Canada, (2)Psychology, York University, Toronto, ON, CANADA*

Background: Although autism spectrum disorder (ASD) is a lifelong disorder, much of the current literature has been focused on the experiences of families with young children. As the child matures, the research becomes sparser and the experiences, needs, and outcomes of individuals and their families during the period of adolescence and adulthood have remained largely unexamined. The limited number of studies on this population suggest that adolescence is a challenging and resource-intensive time for families.
Objectives: To describe and compare the lived experiences of parents raising an adolescent with ASD in three different outcome groups: poor, medium, and good
Methods: This study was conducted as part of a larger study following the outcomes of adolescents who previously received early intervention. The adolescent participants in this sample were 14 to 20 years old and were being assessed on their cognitive ability, adaptive behaviour, academic skills, autism symptom severity, and social-emotional functioning. Semi-structured in-depth interviews ranging from 1 to 1.5 hours long were conducted with 9 families with adolescents diagnosed with ASD and variable cognitive ability. Thematic analysis was used to analyze the parents' perspectives and feelings about the meaning of ASD, current experience with raising an adolescent with ASD, changes from childhood to adolescence, and expectations for the future.
Results: Four themes were constructed to represent the parents' narratives of their caregiving journey: 1) Rippling Effect of Loss; 2) Becoming a Parent-Professional; 3) One Size Fits None; and 4) Preparing for "The Future". Parental narratives reflect the tension they experience with the school system and the frustration with dealing with services that do not grow with their child's needs. Findings also indicate that, over the years, parents develop a specialized skill set that helps them navigate the ever-changing ASD landscape.
Â Conclusions: Â Many parents reported more positive experiences from childhood to adolescence. Parents found that they felt more empowered and confident with their knowledge of ASD to better advocate for their adolescent. The results of this study have several important implications, including the need for service and education providers to actively involve parents in the treatment of their child, as well as to increase appropriate services for adolescents that target both ASD and comorbid mental health challenges.

218 **144.218** Parent Perceptions of Self-Determination for Adolescents with ASD

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Background: Self-determination refers to the concept of acting as a causal agent in one's life and includes skills such as setting goals, making decisions, problem-solving, and self-advocacy (Wehmeyer et al., 2010). Self-determination and self-advocacy skills have been linked to positive outcomes for individuals with disabilities generally, including greater likelihood of postsecondary education (Test, Fowler, & Kohler, 2013). However, documentation of self-determination skills among youth with ASD is only beginning. Carter et al. (2013) examined parent ratings of self-determination skills for their children with ASD or intellectual disability, noting that parents rated self-determination skills as important but indicated that their children did not perform these skills well. The present study sought to further document parents' perceptions of self-determination for their children with ASD.
Objectives: The primary objectives of the present study were to document parents' awareness of the concept of self-determination and examine ratings of child self-determination skills. A further objective was to preliminarily examine variables associated with self-determination, including child age, degree of school inclusion, and parent familiarity with self-determination.
Methods: Data for the present study came from an anonymous online survey distributed to parents through the mailing list of a university-affiliated autism center. Parents completed demographic questions and measures assessing child self-determination. Parent perceptions of child self-determination were assessed using the AIR Self-Determination Scale (Wolman et al., 1994) and a set of questions regarding self-determination component skills developed by Carter et al. (2013).
Results: Survey participants included 56 parents with a child between the ages of 11 and 21 (M = 15.6, SD = 2.7) diagnosed with ASD by a pediatrician, psychologist, or other specialist. (See Table 1 for demographic information.) Nearly one third (30%) of parents reported that they were not at all familiar with the concept of self-determination; 50% reported that they were somewhat familiar; and 20% indicated that they were very familiar with the concept. Most parents rated each self-determination component skill to be very important, but less than 20% indicated that their children performed any of the self-determination skills very well (See Table 2). Multiple linear regression was used to examine predictors of parents' ratings of child self-determination on the AIR Self-Determination Scale. Child age, degree of inclusion in integrated school settings, and parent familiarity with self-determination were entered as predictors. The full model was significant (F = 5.06, p < .01) and accounted for 24% of the variance in global self-determination ratings. Only degree of inclusion emerged as a significant predictor (t = 3.69, p < .01), with higher self-determination ratings for youth who spent more time in integrated educational settings (r = .48, p < .01).
Conclusions: Though self-determination skills are increasingly identified as important for youth with ASD, nearly one third of parents in the current study were unfamiliar with the concept. Consistent with prior research, parents rated self-determination skills as important for their children but indicated that their children did not perform the skills well as present. Future research should continue to examine potential predictors of self-determination for adolescents with ASD.

219 **144.219** Parent Perspectives on Participating in Intervention Research with Their High-Risk Toddler

E. A. Karp[1]*, K. Pickard*[2]*, K. Ragsdale*[1]*, B. Ingersoll*[2]*, P. J. Yoder*[3] *and W. L. Stone*[1]*, (1)Psychology, University of Washington, Seattle, WA, (2)Michigan State University, East Lansing, MI, (3)Vanderbilt University, Nashville, TN*

Background: The research community is increasingly using randomized-controlled trials (RCT) with high-risk (HR) siblings of children with autism spectrum disorder (ASD) to examine the extent to which early intervention ameliorates ASD symptomatology. However, to date, few studies have solicited parents' perspectives regarding their decisions and experiences related to participating in intervention research with their HR toddlers. Understanding the perceptions of stakeholders (i.e., parents) who participate in research, often before ASD symptoms have emerged, will provide valuable information regarding best practices related to research with HR toddlers.
Objectives: To understand parents': 1) motivation to participate in and experience during intervention research with their HR toddler; and 2) opinion about the conceptualization of providing preventative intervention to HR toddlers.
Methods: Parents enrolled in an RCT examining the efficacy of ImPACT, a parent-mediated social communication intervention, were invited to participate in an interview regarding their experiences in this study. Consenting parents assigned to both the intervention and control groups completed a semi-structured interview at time points corresponding to 3 or 6 months after the intervention group completed the 12-week intervention. Interviewers and coders were independent of the main study. Parents were asked about what motivated them to participate in the study, their experience participating in the study, and what they think about the concept of intervention or prevention for HR toddlers. All interviews were recorded, transcribed and checked for accuracy. Grounded theory and mixed method analysis were used. Data collection is ongoing.
Results: Preliminary results are presented for parents in the intervention (*n*=9) and control group (*n*=5) who completed interviews. Categories and subcategories of responses were generated using grounded theory (Table 1). Parents from both groups felt positively about their group assignment and were motivated to enroll in the study to track their child's development. Fewer than half reported being concerned about their child's development at the time of enrollment. Both groups felt that the assessment process was educational, either because it enabled them to monitor their child's progress or because they learned about interacting with their child based on the assessor's style. When asked about the concept of preventative research, approximately 20% of parents described feeling torn between not wanting to change their child with ASD or wanting to prevent challenges associated with ASD.
Conclusions: This study revealed novel information related to parents' decisions to enroll in research with their HR toddler, their experience participating in research, and their perceptions about preventative research. Of particular note is that not all parents were concerned about their child's development when enrolling, and that parents in both groups were satisfied with their group assignments. These results emphasize that though parents are enrolling in an RCT which includes an intervention condition, many parents may be motivated and satisfied by assessments offered. Results also suggest that a minority of parents feel conflicted about preventative interventions as it relates to their older child. This information has implications for future HR studies, both for understanding what motivates parents to participate in research and for conceptualization of these projects.

220 **144.220** Parent Reported Child Attention Problems and Depression Related to Parenting Stress in ASD

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Background: It is well established that parents of children with autism spectrum disorder (ASD) report more stress than parents of typically developing (TD) children (Hayes & Watson, 2013). Common parent-reported stressors include child externalizing behaviors (Baker et al., 2003), social communication impairment, and restrictive and repetitive interests (Hastings & Johnson, 2001). A less studied factor related to parenting stress may be the presence of comorbid symptoms (Simonoff et al., 2008). Research over the past decade has confirmed comorbidities between ASD and a wide array of psychiatric disorders, of which attention difficulties (Matson & Nebel-Schwalm, 2005) and depressive symptoms (Kim et al., 2000) are commonly noted. Understanding the various mechanisms underlying parental stress is crucial as it informs future interventions to better support families.
Objectives: The objective of our study was to investigate how attention difficulties and child depression symptoms influence frequency of stress events in parents of children with ASD.
Methods: Our sample included 100 children (ages 3:0 to 6:11) and their parents.Â Sixty-one TD children (37.7% female) and 39 children with ASD (25.6% female) participated. Parents' ratings from the Behavior Assessment System for Children—Second Edition (BASC-2; Reynolds & Kamphaus, 2004) were used to evaluate children's attention problems and depression symptoms. Frequency of parenting stress was measured using the parent-reported Parenting Events Questionnaire (Crnic & Greenberg, 1990).
Results: A serial mediation model was conducted using the SPSS 24 macro PROCESS (Hayes, 2008), which provided bootstrapped estimates of the indirect effects based on 5000 resamples. The results indicated that status was positively associated with attention-related problem behaviors (B = 14.64, p < .001), child attention problems was positively associated with child depression symptoms (B = .70, p < .001), and depression symptoms were positively associated with frequency of parenting stress (B = .30, p = .003). The direct effect was significant (B = 8.21, p < .001). Results of the bootstrapping analysis supported the mediational role of child's depression symptoms (B = .27, CI95 = .10 to.45) in the association between status and frequency of parental stress. The role of attention problems was not significantly associated with frequency of parental stress (B = .08, CI95 = -.15 to .32). The results support a serial indirect effect in the relation between status and frequency of parenting stress such that when compared to TD children, children with ASD had higher attention problems, which was associated with higher depression symptoms, which predicted greater frequency of parenting stress (B = 2.76, CI95 = .96 to 5.60). Additionally, this model accounted for 35% of the variance in predicting frequency of parenting stress in our sample.
Conclusions: Our results suggest that compared to TD children, children with ASD have higher levels of attention problems predicting more depressive symptoms which is associated with greater parental stress. These findings suggest that targeting interventions to decrease child attention difficulties and depressive symptoms may play a role in decreasing parenting stress. Future research should explore the relations between parenting stress and other common comorbid psychiatric symptoms.

221 **144.221** Parent Responsive Direction in Play and Children's Language and Social Development in ASD

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Background: Parent responsive communication, or that which is contingent on a child's interest and focus of attention, predicts gains in language and social functioning for children with typical development (Tamis-LaMonda, Bornstein & Baumwell, 2001). Children with autism, who demonstrate difficulties in understanding social-pragmatic cues such as joint attention (Mundy, Sigman, Ungerer & Sherman, 1986), may be particularly dependent on parenting that is responsive to their current interest and focus. In a study of 28 preschool-aged children with autism, Siller and Sigman (2008), demonstrated that early maternal responsiveness predicted language acquisition across three years. However, in studies of youth without ASD, parent responsiveness has shown to differentially impact young children as a product of cognitively ability (Green, Caplan & Baker, 2014), with parenting having a greater impact for children with lower cognitive ability. It is unclear what role cognitive ability plays in the influence of parent responsiveness in ASD.
Objectives: (1) To examine how parental responsive direction during parent-child play relates to concurrent and prospective child language and social skills. (2) To assess cognitive ability as a moderator of the relationship between parent responsive direction and child functioning.
Methods: This study examined language and social skills in 4- to 7-year-old children with a confirmed ASD diagnosis (*N*=170) using data obtained from a multi-site longitudinal study collected at three time-points across 1.5 years. All eligible children met clinical criteria for ASD diagnoses according the ADOS-2 and exhibited IQ ≥ 50 as assessed by the WPPSI-III (Weschler, 2002). A coding system of parent verbal direction that coincided with (*responsive* direction) or deterred from (*interfering*direction) child ongoing activity was implemented during a 10-minute parent-child free play interaction. Children's language abilities were assessed using a standardized assessment of spoken language (CASL; Carrow-Woolfolk, 1999) at time-points 1 and 3, and children's social skills were assessed using parent and teacher report of the SSiS (Gresham & Elliott, 2008) at all three time-points.
Results: Preliminary analysis with a subsample (*n*=100), reveals positive associations between parent *responsive* direction and concurrent child spoken language (*r*= .32, p<.05) but not child social skills. Parent *interfering* direction was negatively associated with child spoken language (*r*= -.36, p<.05) and social skills (*r*= -.24, p<.05). Future analyses will utilize multiple regression and latent growth modeling in MPLUS to assess parent direction (*responsive, interfering*) as it predicts change in child language and social skills, respectively, over time. Analyses will control for child negativity and engagement with toys during the interaction. Child cognitive ability will be assessed as a moderator by adding the appropriate interaction terms to the model.
Conclusions: Parental responsive and interfering direction demonstrate concurrent relationships with child language and/or social skills. However, given evidence that child behavior predicts later parenting in ASD (Markus et al., 2000), it will be important to employ longitudinal methods to predict downstream child development while controlling for prior levels of child functioning. Findings will serve to characterize dyadic interaction styles that are predictive of positive developmental outcomes in ASD, and may inform family-focused interventions.

222 **144.222** Parent Strategies to Support Mealtime Participation for Children with Autism Spectrum Disorders: Integration of Behavior and Narrative Data

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Background: Â Mealtime is significantly affected in families with children with autism spectrum disorders (ASD) as they report significant mealtime behaviors, increased focus on the child with ASD, disrupted eating patterns, and an overall increased level of stress. Families use a number of strategies to support their child with ASD's engagement in mealtime, but these strategies have not yet been clearly identified within natural mealtime contexts.
Objectives: Â The purpose of this study was to identify and triangulate parent reported and observed strategies used to support their child's mealtime participation.
Methods: Twelve families with a child between the ages of 2 and 7 years with ASD were recruited to participate in 1 to 2 videotaped mealtime observations and 1 to 3 semi-structured interviews. Videos were reviewed to identify strategies families used during mealtimes to facilitate participation. The strategies were identified, defined, and arranged into categories using qualitative conventional content analysis. The categories were used to develop coding schemes with detailed definitions that were used to code family mealtime videos with each video being coded independently by two research team members. Agreement measures of inter-rater reliability were calculated. Thematic analysis was used on the transcribed parent interviews to identify strategies parents reported using during child eating experiences and family mealtimes. Categories of observed behavioral strategies were compared to the themes of reported parent strategies.
Results: Six categories of observed parental strategies were identified through the mealtime video data: 1) Parent Intervening and Ignoring, 2) Meal Preparation and Adaptability, 3) Positive Reinforcements, 4) Play and Imagination, 5) Distractions, and 6) Modeling. In contrast, only four primary themes of parent reported strategies were identified through the parent interview data: 1) Setting the Mealtime Stage, 2) Essential Food Modifications, 3) Social Strategies, and 4) Letting Go. When describing mealtime strategies, parents consistently discussed the importance of the environmental and child context in determining when and what strategies they may use to support their child. Families were observed to and reported using multiple strategies within and across mealtimes with variable success, highlighting the individualistic nature of feeding challenges in children with ASD. However, the observed and reported family strategies were not necessarily the same.
Conclusions: Similarities and differences were found when comparing the observed and parent-reported mealtime strategies to support their child with ASD. For example, parents described the strategies they used to prepare and create an environment to promote food acceptance during mealtime (Setting the Mealtime Stage), which was clearly confirmed through their behaviors during the observed mealtimes (Mealtime Preparation/Adaptability). However, multiple direct strategies were observed during mealtime (i.e., Parent Intervening/Ignoring and Distractions) that were absent in the parent interviews. Identifying the relationship between parent-reported and observed mealtime strategies will allow for a richer understanding of the context and motivation leading to parent behaviors during family mealtimes that will support the development of family-centered interventions to promote mealtime participation for children with ASD.

223 **144.223** Parent-Mediated Training for Behavior Problems in Children with ASD: We Have Miles to Go

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Background:
Estimates suggest more than 90% of children and youth with ASD experience challenging and disruptive behaviors some time during their life (Matson, Wilkins, & Macken, 2009). Children with ASD display more challenging behaviors compared to children with other disabilities and those behaviors are associated with a variety of negative outcomes. Caregivers of children with ASD report higher stress compared to parents of neuro-typical children and parents of children from other disability groups (Baker-Ericzen, Brookman-Frazee, & Stahmer, 2005; Hayes & Watson, 2013). Family-centered care, specifically parent support and training, is imperative for these families. Numerous studies demonstrate the positive impact of parent training for improving developmental skills such as social communication in children with ASD, however, few have specifically addressed problem behaviors and even fewer have examined parental factors, such as stress or competency. **Objectives**: The current analysis represents part of a comprehensive meta-analysis concerning parent mediated interventions specifically targeting parents of children with Autism Spectrum Disorder and behavioral challenges. Conference participants should expect to gain knowledge of the current research base concerning parent-mediated interventions for problem behaviors in children with Autism Spectrum Disorder, specifically highlighting the large gaps in this research to date. The current research base, as well as its effectiveness in addressing parent concerns and characteristics will be discussed. **Methods:** Computer-based database and ancestry searches, and manual searches of peer-reviewed articles and dissertations were used to identify studies meeting inclusion criteria. To be included studies had to: (1) use a group design to evaluate the outcomes of a parent training or intervention for parents/caregivers of children with ASD, (2) report original data, (3) be published in English, (4) include five or more participants in their experimental groups, and (5) specifically be designed to address problem behaviors.
Â **Results:**
Â Review of the literature only produced seven group design studies that included parents as the key implementers of interventions designed to decrease disruptive behavior of their child with ASD. Of those studies, only three measured parent variables. Although effect sizes for children's behavior based outcomes were positive, ranging from -0.73 to 2.02, direct comparison of outcomes was not possible because only 3 studies used the same outcome measures for child problem behavior. Overall, sample sizes were modest (range = 16 to 64) and dropout rates ranged from 5.1 to 48.5%. Neither implementation variables nor mechanisms of change variables were considered or mentioned in any of the seven studies.
Â **Conclusions:**
Â The current analysis clearly highlights a need for parent-mediated interventions to address the needs of families of children with Autism Spectrum Disorder, specifically for problem behaviors. While discussion of a "need" persists, the current analysis would suggest we are much further behind in actually "doing" something to address that need. This review highlights both the dearth of studies and research investigating parent-based problem behavior intervention for ASD, as well as the large gaps in our knowledge about these interventions. Recommendations and directions for future research will be discussed.

224 **144.224** Parental Attributions of Behavior in Toddlers with ASD-Related Concerns

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Background:
Parental attributions of their children's behaviors have important implications for parent-child interactions and expectations. For typically developing (TD) children, parents generally attribute good behaviors as internal, stable, and controllable, while misbehaviors are perceived as external, temporary, and uncontrollable (Morrissey-Kane & Prinz, 1999). Conversely, parents of children with autism spectrum disorder (ASD) perceive misbehavior as more internal and controllable than good behavior (Wittingham et al., 2008). However, little is known about the behavioral attributions of parents who have ASD-related concerns about their toddlers. This study compares parental attributions about their toddler's behavior across three groups: parents with developmental concerns, ASD concerns, or no concerns about their toddler.
Objectives:
Do parents in the three groups differ in: (1) behavioral examples they provide when describing their toddler's good behavior and misbehavior; and (2) their attributions for their toddler's good behavior and misbehavior?
Methods:
The sample comprises 101 parents/toddlers recruited from primary care practices and early intervention programs through a longitudinal community-based study. The groups comprise parents with either self-reported ASD-related concerns, other developmental concerns (e.g., language; motor), or no concerns about their toddler (Table 1). Data collection is ongoing.
Parent's descriptions and attributions of their toddler's behavior were collected via the Parental Attributions Questionnaire, which asks parents to describe two scenarios: one in which their child exhibited good behavior and another in which they exhibited misbehavior. In addition, parents rated (on a 5-point Likert scale) the degree to which they view these behaviors as internal, stable, and controllable. Two examiners independently coded parents' scenario descriptions for content related to social behavior and compliant behavior (see Table 2 for examples of behaviors coded for each scenario type). Interobserver agreement was excellent (Cohen's κ=.814).
Results:
A 3 (group) x 2 (scenario; good behavior or misbehavior) x 2 (behavior type; social or compliant) repeated-measures ANOVA indicated that: (1) across groups, parents provided more examples of behaviors for the misbehavior scenario than the good scenario, p=.014; and (2) regardless of scenario type, the ASD concerns group provided fewer social behavior examples than the developmental concerns group, p=.019.
A 3 (group) x 2 (scenario) repeated-measures ANOVA was conducted for each attributional domain. For the *internal* domain, good behaviors were rated as more internally driven than misbehaviors, p=.001. For the *stability* domain, (1) good behaviors were rated as more stable than misbehaviors, p<.001; and (2) the ASD concerns group rated misbehaviors as more stable than the developmental concerns group, p=.008. For the *control* domain, the ASD concerns group rated behaviors as less under their child's control than the developmental concerns group, p=.015.
Conclusions:
Relative to the developmental concerns group, parents of children with ASD-related concerns reported fewer social examples for both the good behavior and misbehavior scenarios. This likely reflects their toddler's limited socially-directed behavioral repertoire. Additionally, the parents with ASD concerns perceived their toddlers' good behavior and misbehavior as less under their child's control, and their misbehavior as a more stable characteristic. These findings have potential implications for parents' adoption of and adherence to intervention.

225 **144.225** Parental Involvement in Educational and Intervention Services for Young Children with Autism

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Background: Parental involvement in autism intervention is encouraged by the National Research Council (2001); however, the specifics of involvement are unclear. Previous research has found that parents report being involved in many ways, such as applying educational principles outside of school/therapy, facilitating between different providers, attending conferences/meetings, and communicating with personnel (Granger, des Rivières-Pigeon, Sabourin, & Forget, 2012; Solish, Perry, & Shine, 2015; Stoner & Angell, 2006). Correlates of involvement have been investigated (e.g. Benson, Karlof, & Sipersetin, 2008; Solish & Perry, 2008), though correlates of each type of involvement remain unclear. Similarly, while involvement has been found to be positively related to parental satisfaction with educational services (Renty & Roeyers, 2006; Zablotsky, Boswell, & Smith, 2012), how each type of involvement is related to satisfaction has not yet been investigated.
Objectives: The current study aimed to determine how parents are involved in their child's services, factors related to involvement, and the relationship between involvement and service satisfaction.
Methods: Parents of children with autism between the ages of 3-8, recruited from parent support groups and autism organizations, were invited to participate in a survey. The survey examined parent involvement in and satisfaction with educational and behavioral intervention (BI) services.
Results: Twenty-nine parents of children with autism (average age: 5.7) completed the survey. The majority of parents reported wanting to be involved to know what their child was learning (93%) and generalize skills (86%). Sixty-two percent of participants reported at least two barriers to involvement. Child age was significantly negatively associated with amount of time spent trying to implement strategies learned at school (Spearman's r=-.584, p=.001), as was number of children in the house (r=-.503, p=.007). Number of hours worked outside the home was negatively correlated with attending BI meetings (r=-.515, p=.014). Ethnicity, income, and parent education were not related to any involvement type (ps>.05). Parents who reported spending more time implementing strategies learned from school were more likely to be satisfied with school (r=.760, p<.001). Parents who spent more time being directly involved in their child's BI sessions were less likely to be satisfied with those services (r=-.392, p=.048). Other school and BI involvement types were not significantly correlated with satisfaction.
Conclusions: This study demonstrates the importance of studying parental involvement in the context of different types of involvement, as different correlates were related to different aspects of involvement. Parents of older and multiple children, for example, may need unique methods to increase their school-based involvement. When assessing involvement, professionals may benefit from understanding that different involvement types may be especially impactful when it comes to parental satisfaction. Specifically, implementing school-based strategies in everyday life and participating directly in BI sessions were related to satisfaction, whereas other aspects of involvement were not. BI teams may want to assess whether parents who are heavily involved in BI sessions are satisfied with those services and whether other involvement types might better suit them. Future research should expand on these findings, for example by exploring child factors related to the various types of parental involvement.

226 **144.226** Parental Quality of Life in ASD Families: Influence of Autism Severity, Adaptive Functions, Availability of Public Health Services and Prospective Assessment of the IMPACT of Case Management Intervention on Parental Stress.

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Background: Parents of autistic individuals are under great emotional pressure for multiple reasons. Autism spectrum disorder (ASD) in a child has a major negative impact on the quality of life (QoL) of his/her parents. "Case management" intervention should indirectly improve parental QoL by coordinating the diagnostic assessments, therapeutic interventions, school- or work-related programs, and daily life assistance provided by "care managers" to autistic individuals and their families.
Objectives: (1) To assess the QoL in parents of autistic individuals and to characterize its relationship with the severity of their child's autism and the availability of public services; (2) To measure the impact of one year of case management intervention (T1) on the QoL recorded prior to treatment (T0). The present communication is focused on objective n.1.
Methods: Parents of 39 autistic individuals consecutively recruited for the Case Management Program supported by Regione Lombardia were assessed at T0 for quality of life (QoL) using both the WHOQOL and the recently developed QOLA (subscale A=general QoL, subscale B=Autism-related QoL). Their autistic offspring was assessed using WISC-III, Leiter-R or Raven's matrices for IQ, ADOS, VABS, SRS, TRF and CBCL. Data were analysed by c^2 test and ANOVA, correlations by Pearsons's R statistics.
Results: Data are available on 29 patients (M:F=25:4) and their parents at T0. WHOQOL and QOLA-A provide superimposable measures of maternal and paternal QoL (mean scores are 84.58 and 82.05 for WHOQOL, 84.15 and 89.29 for the QOLA-A, respectively). Parental QoL is worsened by the child's ASD (maternal and paternal QoL scores are 66.70 and 68.85 for the QOLA-B, respectively). QoL is lower for both fathers and mothers if their autistic offspring is non-verbal, has co-morbid intellectual disability and intense mannerisms. Paternal QoL appears more sensitive to low imagination and creativity, and to intense stereotypic behaviors in the affected child, as recorded by the ADOS. VABS scores in the affected offspring and parental QoL are significantly correlated. Mothers appear especially sensitive to lack of verbal communication and fathers to lack of socialization. Strikingly, total WHOQOL scores display a significant positive correlation with QOLA-A scores for "availability of health services for ASD" in fathers (R=0.529, P<0.05), while mothers display the opposite trend (R=-0.326, P=0.104).
Conclusions: Overall, parents of individuals with ASD display sizable levels of autism-related stress. Parental QoL is especially hampered by the child's low functioning, comorbid intellectual disability and expressive language deficits, as compared to lack of social non-verbal communication. Motor stereotypies and mannerisms also have a major negative impact on QoL both for fathers and mothers. Fathers are strongly more reliant on social support and efficient health services as compared to mothers, who may actually feel worse if their autistic child is "taken over" by efficient health services without maternal involvement in the process. We are currently verifying the latter hypothesis in the entire data set of 39 families analyzed at T0, while the efficacy of case management intervention on improving parental QoL is also being prospectively assessed at T1 (i.e., after 12 months of intervention).

227 **144.227** Parental Stress, Parental Efficacy and Problem Behaviors in Children with Autism Spectrum Disorder: A Structural Equation Analysis

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Background:
Several studies have examined the role of parental stress on child outcomes, however there is little research examining positive parental characteristics, such as self-efficacy, that may reduce the impact of stress on the family. The direction of effects between parental stress, parental efficacy, and child problem behavior is also unclear.
Objectives:
To develop and test a longitudinal model including the latent variables (LVs) parental stress, parental efficacy, and child problem behavior and estimate their effects on each other over time (cross-lagged effects) using structural equation modeling (SEM).
Methods:
The study included 350 hospitalized children and adolescents with an Autism Diagnostic Observation Schedule-2 (ADOS-2) confirmed ASD diagnosis admitted to six specialized inpatient psychiatry units and prospectively enrolled in the Autism Inpatient Collection (AIC) study. Parents (N=323) were administered the Aberrant Behavior Checklist Irritability (ABC-I) subscale, Parent Stress Index Short Form (PSI-SF-4) and Difficult Behavior Self-efficacy Scale (DBSS) at admission, discharge, and 2-month follow-up. The hypothesized model was specified to have both measurement and path model components to make up the overall structural model composite. The measurement model contained three LVs – Parental Stress, Parental Efficacy, and Child Problem Behavior – which were measured using observed variables of each as indicators. The substantive part of the model involved the correlations and possible causal paths between the LVs (see Figure 1).Â Each LV was specified to be correlated with the other two LVs within a given time period, to predict itself at all later points in time (stability), and to be a predictor of the other two LVs measured at the immediately following time period (cross-lagged effects). Structural equation modeling was conducted using AMOS software version 20.
Results:
There were no significant differences between males and females on any of the demographic (age, ethnicity, race) or clinical variables (length of stay, non-verbal IQ, intellectual disability, expressive communication, adaptive behavior, or self-injurious behavior) (see Table 1). The majority of parents were mothers (84%), married (58%), average age of 42 years old. SEM results indicated the three latent variables were significantly correlated with each other at each respective time point (all p-values < .005) in a manner that supported the validity of each.Â Parental efficacy was negatively correlated to both parental stress and child problem behavior and parental stress was positively correlated with child problem behavior. The overall model fit the data well, $\chi^2 = 229.2$, $df = 138$, $p = 0.001$; RMSEA = .04; CFI = 0.97. Two cross-lagged effects were found. Parental stress at admission predicted parent self-efficacy at discharge, $\beta = -0.33$, $p=0.002$, and parental stress at discharge predicted parental efficacy at follow up, $\beta = -0.34$, $p=0.001$. There were no other significant cross-lagged effects in this model.
Conclusions:
Results revealed a negative association between parental stress and parental efficacy which was consistent over time. Interventions to develop coping/behavioral management skills to reduce stress related disorders in parents may be important for mitigation of problem behaviors among children with ASD. Employing advanced statistical modeling methods (SEM) advances our knowledge in this field.

228 **144.228** Parenting Stress and Emotional Availability in the Families of Children with Autism Spectrum Disorder

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Background: Â Rearing a child with Autism Spectrum Disorder (ASD) is a unique challenge for both parents. Parenting a child with ASD is stressful and impacting overall quality of life. In the last decades, a number of factors have been found as impacting parents' psychological well-being in the family of children with ASD. However, far too little attention has been paid to the dyadic quality of emotional availability in parent-child interactions, considering the perspectives of both the adult and child.
Objectives: Our main goal was to explore the association among parenting stress, observed behaviors of children and parents during interaction and a number of child and family characteristics, including autism severity, cognitive functioning, age and SES.
Methods: Â Participants were 40 mothers and 40 fathers of children with ASD (Range chronological age = 18 - 48 months). Data were collected using The Emotional Availability Scale (EAS), the Parenting Stress Index-Short Form (PSI-SF), theÂ Autism Diagnostic Observation ScheduleÂ (ADOS) and theÂ GriffithÂ Mental Development Scales (GMDS). EA in parent-child dyads was coded using the EAS which includes four scales reflecting parents' sensitivity, structuring, non-intrusiveness and non-hostility, and two scales reflecting child's responsiveness and involvement. The data were collected during 10-min play sessions for mother-child and father-child dyads.
Results: Â Parenting stress and emotional availability scales were found to be associated in the present study. In particular, parenting stress scores were negatively correlated withÂ the scores for Emotional Availability. The preliminary results showed that the Parent-Child Dysfunctional Interaction and the Parenting Distress scales of the PSI-SF were negatively correlated with the Sensitivity scale of the EAS for mothers.
Conclusions: These results suggest that the emotional availability and the psychological well-being of parents are connected. In the family of children with ASD, it is important to measure the emotional exchange of mothers and fathers to assess parent-child interactions and to explore parents' distress. This study might be useful to implement treatments for children with ASD focusing on parent-child interaction and on supporting the development of high-quality dyadic relationship.

229 **144.229** Portrayal of ASD in Canadian Media: A Framing Analysis

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Background: How media stories are framed can significantly influence societal perceptions of issues, influence demand for health services, shape decisions related to health care and education, and inform policy. Previous framing analyses of media representations of ASD from the United States (Kang, 2013), the United Kingdom (Huws, 2010), Australia (Jones & Harwood, 2009), and China (Bie & Tang, 2015), were often inaccurate and negative in focus, perpetuating misconceptions and stereotypes of ASD. However, Canada is recognized as being relatively well resourced for health care and other services for people with ASD and their families. Therefore, the Canadian media may portray ASD differently, leading to different perceptions of ASD in Canada than in other countries.
Objectives: We used frame analysis to investigate how newspapers across Canada covered ASD over a 5-year period (2011-2015). Specific research questions related to the coverage of ASD included: (1) What were the main issues? (2) Who were the primary sources cited or quoted? (3) What discourse was used? (4) What tone was used?
Methods: The Canadian Newsstand Complete database was used to collect print news articles from two national and 8 regional Canadian broadsheet newspapers representing all geographic regions. Search terms were autis* OR ASD OR Asperger* in the article headline. Working frames were derived based on an in-depth content analysis of the articles, and a codebook was developed for data extraction. Inter-coder reliability for 10% of articles for each coding category was moderate to very strong (Cohen's Kappa = 0.60-0.88 across categories).
Results: A total of 397 unique articles were found. The main issues covered were (1) infrastructure (e.g., services, funding; n=128), science (n=80), family story (n=70), victimization of/by the person with ASD (n=35), and advocacy (i.e., awareness/acceptance of ASD; n=33). Primary sources cited were family members (n=128) and academics/scientists (n=106). Persons with ASD were infrequently cited (n=24). Human-interest discourse was most common (n=332), followed by scientific (n=50) and policy (n=15) discourse. All articles coded as scientific discourse focused on research, but 10% of scientific topics (research findings) were framed within human-interest discourse. Most articles presented neutral information, including both positive and negative sides (n=167) or descriptive information (n=110). Eighty articles were exclusively positive in tone, dominated by advocacy, family story, and infrastructure topics; 41 were negative in tone, dominated by victimization and family story topics. The word "suffer" was included 98 times within 70 articles, and the word "burden" was included 42 times in 36 articles.
Conclusions: Increased understanding of media portrayal of ASD can provide context for societal understanding of ASD, and resulting acceptance and inclusion, or stigma and discrimination. Portrayals of ASD in Canadian newspapers were more neutral or positive than previous frame analyses from other countries. However, the words "suffer" and "burden" were frequently used, even in positively framed articles. Infrastructure was a more frequent topic compared to other jurisdictions, perhaps due to the amount and variety of programs in Canada. Similar to previous studies, the voices of people diagnosed with ASD were largely unheard.

230 **144.230** Predicting Anxiety in Autism Spectrum Disorder: The Roles of Parenting and Emotion Regulation

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Background:
Positive parenting is characterized as above average levels of warmth, affection, responsiveness, and involvement and is positively associated with healthy child adjustment and lower levels of internalizing behaviors in children, including those associated with anxiety. Because children with Autism Spectrum Disorder (ASD) are at an increased risk of experiencing higher levels of anxiety than their typically developing peers, positive parenting might be particularly important for this population. Another potential predictor of high anxiety in children with ASD might be emotion regulation and emotional coping skills. Individuals with ASD have been shown to have differences in and difficulties with emotion regulation compared to their typically developing peers which might further explain some of the increased levels of anxiety.
Objectives:
In the present study, we sought to elucidate the relations between positive parenting, emotion regulation and coping skills, and anxiety-related child behavior in children with ASD. We hypothesized that both positive parenting behaviors and emotion regulation and coping skills would significantly predict anxiety-related behaviors in children with ASD. Specifically, higher levels of positive parenting and higher levels of emotion regulation and coping skills would both predict lower levels of anxiety-related behaviors.
Methods: Parent reports of anxiety-related child behavior and parenting behavior and child self-reports of emotion regulation and coping strategies were obtained from a sample of parent-child dyads in which the child has a diagnosis of ASD (*N*=23). We examined the ways in which positive parenting behaviors and the child's emotion regulation and coping skills predict anxiety-related behavior in the child.
Results:
Results of a simple linear regression indicated that positive parenting behaviors (b(21)= -.799, p <.001) and the child's emotion regulation and coping skills (b(21) =-.295, p <.05) both significantly predicted anxiety-related child behavior. The overall model (F(2,20) = 10.67,Â pÂ = .001) accounted for 52% of the variance (R^2=.516) in anxiety-related behaviors in children with ASD.
Conclusions:
These findings further evidence the importance of providing positive parenting based interventions to parents of children with ASD and interventions focused on emotion regulation and coping skills to children with ASD in order to decrease the levels of anxiety experienced. It might also be that increased emotion regulation and coping skills are a mechanism through which positive parenting behaviors decrease child anxiety-related behaviors. Preliminary analyses indicate a trend towards mediation and further analyses will be conducted when expected sample size is reached to determine if the child's emotion regulation and coping skills are acting as a mediating variable between positive parenting behaviors and the child's anxiety-related behaviors.

231 **144.231** Predictors for Parent Wellbeing Around the Time of Young Child ASD Diagnosis

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Background: Research has established that the stress associated with raising a child with an Autism Spectrum Disorder (ASD) has considerable impact upon parent wellbeing (Karst, 2012). However, there is a relative paucity of studies investigating parent wellbeing specifically around the time a child is diagnosed, resulting in a limited understanding of the factors that have the greatest impact upon parent wellbeing at this particular point in time. Stress around diagnosis is reported to trigger uncertainty and helplessness in parents (Bruey, 2004; Schall, 2000), and acute psychological distress (i.e., anxiety, depression symptoms), which risks becoming stable and ingrained over time (Estes et al., 2013). Therefore, further investigation of factors which contribute to parent wellbeing during this time will develop current understanding and propensity to support parent wellbeing.
Objectives: This study investigated a variety of factors as potential predictors of concurrent parental wellbeing around the time their child was assessed for an ASD. It was predicted that parents at increased vulnerability would use poorer coping mechanisms and have poorer wellbeing outcomes.Â
Methods: Forty-seven parents with children aged 2-4 years who were recently diagnosed/assessed for an ASD participated in the study. Parents completed questionnaires regarding vulnerability factors (i.e., parenting self-efficacy, ASD trait expression, and socioeconomic status), coping styles (i.e., use of social support, engagement with stressors, distraction/disengage from the issue), and current wellbeing (i.e., depression, anxiety, affect). Children were assessed using ADOS-2 to confirm the appropriateness of their community-assigned ASD diagnosis.
Results: Parents who reported more symptoms of depression and stress around the time of their child's ASD diagnosis were those also reporting greater vulnerability in terms of lower parenting self-efficacy, and those who more often used distraction/disengagement as a method of coping. Furthermore, parents who reported more symptoms of anxiety and more negative affect around this time were also those who reported increased vulnerability in terms of greater ASD trait expression, and also more often used distraction/disengagement coping. By contrast, parents who reported more positive affect around the time of their child's ASD diagnosis were those who also reported greater parenting self-efficacy and used reframing of stressors as an adaptive coping style.
Conclusions: The clear patterns of concurrent association between elevated vulnerability factors, the use of less adaptive coping styles, and poorer wellbeing among parents of young children with recent ASD diagnoses highlight the need to target aspects of parent functioning directly at this point in the family's journey with ASD. Given that the focus of practitioners and parents is often highly focused on the child, it is particularly important that focus during the diagnostic period incorporates parent support. Professional support that increases parenting confidence may promote more adaptive styles of coping, both of which are clearly indicated in order to improve parent wellbeing.

232 **144.232** Predictors of Anxiety in Parents of Adolescents and Young Adults with Autism Spectrum Disorder (ASD)

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Background:
Previous research has suggested that parents of children with autism spectrum disorder (ASD) have higher levels of stress and higher prevalence of anxiety than both parents of typically developing children and other disabilities. During transition from secondary school into adulthood, individuals with ASD lose their entitlements to many services they have received while in school, and parents often must take on increased responsibility for service coordination. Therefore it can be expected that this period will be particularly stressful for parents and might lead to increased levels of anxiety. There are however, notable individual differences in the way individuals respond to stress. It has been shown that particular individual characteristics, as well as environmental characteristics, can on one hand prolong the effects of negative life events, making individuals more susceptible to the negative psychological effects of chronic stress, and on other hand serve as resilience factors. However, factors that might put these parents at increased risk for developing anxiety are currently under-researched.
Objectives:
To identify factors associated with higher levels of anxiety in parents of adolescents and young adults with ASD, in particular focusing on intolerance of uncertainty (IU), mindfulness, and broader autism phenotype traits (BAP) as parental characteristics, and social support, as characteristic of the environment.
Methods:
Ninety-three parents of adolescents and young adults with ASD (Parents: M_{age}= 50.19 years, SD_{age}= 5.78; 86 females; Children: M_{age}= 19.14 years, SD_{age}= 2.53, range) completed questionnaires assessing anxiety (DSM-5 Dimensional Anxiety Scales; DSM-5 DAS), BAP traits (Autism Quotient-10; AQ-10), mindfulness (Mindful Awareness Scale; MAAS), social support (Social Support Questionaire-6; SSQ-6), and IU (Intolerance of Uncertainty scale-12; IUS-12). Both parents and young people with ASD were participants in the Australian Autism CRC longitudinal School Leavers study.
Results:
No statistically significant association was found between chronological age, gender, BAP traits and anxiety. IU (r= .59, p < .001), mindfulness (r= -.54, p < .001) and level of social support (r= -.42, p < .001) were all associated with anxiety. A multiple regression model was conducted in order to examine relative contribution of these variables in predicting anxiety. The final model accounted for 54% of variance in anxiety, with IU, mindfulness and social support all unique, independent predictors, t = 5.30, p < .001, β = .265; t = -4.31, p < .001, β = -.480; and t = 3.12, p = .002, β = .272, respectively.
Conclusions:
This study identified lower mindfulness, lower levels of social support and higher levels of IU as independent, contributing factors to elevated levels of anxiety in parents of adolescents and young adults with autism. Identifying these risk and resilience factors is of particular importance for informing the effective parental support programs.

233 **144.233** Predictors of Maternal Stress in Pre-School and School Aged Children on the Autism Spectrum

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Background: Mothers of children on the autism spectrum have been shown to experience higher levels of stress than mothers of typically developing children and children with other developmental disabilities (Dumas et al. 1991; Schieve, et al. 2007; Estes et al. 2009; Dabrowska & Pisula 2010). However little is known about whether maternal stressors differ across childhood. Given that that parent stress can have a large impact intervention outcomes (see Osborne et al. 2007 and Strauss et al. 2012), it is important to investigate the factors that influence stress levels in the mothers of young children on the autism spectrum in order to understand how best to minimise parental stress levels and in turn help maximised intervention efficiency.
Objectives: This study aimed to (1) determine if maternal stress levels differ between pre-school aged and school aged children on the autism spectrum, (2) analyse the relationship between family and child characteristics and maternal stress, and (3) identify any differences between the variables that predict maternal stress in pre-school aged children compared to school aged children on the autism spectrum.
Methods: This study investigated maternal stressors in 29 pre-school aged and 27 school aged children on the autism spectrum. Correlation and regression analysis were used to determine the impact of maternal age, family income and various child related factors on maternal stress levels. Specific child related factors used in the investigation were cognitive ability (measured using the WISC-IV and Mullen Scales of Early Learning), autism severity (measured using the ADOS-2), problematic behaviours (measured using the Child Behaviour Checklist), adaptive behaviours (measured using the Vineland Adaptive Behavioural Scales), repetitive behaviours (measured using the Repetitive Behaviour Scale-Revised), and sensory processing challenges (measured using the Short Sensory Profile). Maternal stress was measured using the Parental Stress Index (PSI-SF).
Results: No differences in overall maternal stress levels were found between the two age groups. Correlation analysis revealed that while several child related factors were associated with maternal stress in each age group, maternal age and family income were not correlated with any of the PSI-SF subscales. Hierarchical regression analysis was used to determine which correlates predicted maternal stress after controlling for each child's age, sex, and cognitive ability. Results revealed that maternal stressors differed between the groups. Specifically stressors in the school aged group were found to be related to repetitive behaviours, sensory sensitivities and problematic behaviours, while stressors in the pre-school aged group were mainly associated with adaptive behaviours.
Conclusions: These results indicate that while overall maternal stress levels remain stable over time, mothers' stress levels are impacted by different child-related factors throughout their child's development. These results draw attention to the need to identify the unique factors that have an impact on maternal stress levels at different stages of childhood. In doing so, these findings can help inform clinical practice and provide insight into targeted and effective supports that will enhance the wellbeing in mothers of children on the autism spectrum.

234 **144.234** Predictors of Parent Expectations within an Intervention for Children with Autism

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Background: Â Past literature has emphasized the influence that family and child factors can have on parent expectations. Child variables, such as symptom severity, and family variables, such as ethnicity and socioeconomic status (SES), predicted parent expectations for children with oppositional behavior (Nock & Kazdin, 2001). These variables may be even more salient within ASD, as diagnosis rates and treatment access have been lower among ethnic minority families and families with low resources (Bhasin & Scendel, 2006; CDC, 2014; Liptak et al., 2008). Furthermore, parent expectations regarding the benefit of therapy can influence parent attendance and adherence (Nock et al., 2006;Â Nock & Kazdin, 2001). Therefore, understanding factors that may influence parents' expectations may inform support strategies.
Objectives: The purpose of this study was to investigate how family characteristics (e.g., ethnicity, SES, intervention history) and child characteristics (e.g., ASD symptom severity) predict parent expectations at the start of intervention.
Methods:
Participants. Of 147 preschool children with ASD and their caregivers who were randomized into a larger intervention trial (Kasari et al., 2014), 113 with complete Parent Expectancies Questionnaire (PEQ: Kasari et al., 2015, adapted for this study from Nock & Kazdin, 2001) data were included in the present study (see demographics in Table1).
Measure. The *PEQ*is a caregiver questionnaire that assesses parent expectations on a 5-point scale. Two outcome variables were derived based on factor analyses (Toolan, in prep) including: (a) belief in child improvement (BCI) including 3 items, and (b) treatment credibility (TC) including 8 items. Both BCI and TC are percentage scores where 100%=expectations for timely child improvement (BCI), and the treatment will lead to gains for my child (TC), while 0%=no expectation my child can improve (BCI), and the treatment will not lead to gains for my child (TC). One linear multiple regression model was conducted for each factor. The following parameters were included: SES score (Hollingshead Two-Factor Index of Social Position), ethnicity (dummy coded, white as reference group), MSEL developmental quotient, ADOS severity score, child's early intervention experience (yes/no), and Parenting Daily Hassles frequency percentage score, controlling for site.
Results: Participants entered the intervention with high expectations for both BCI (*M*=72.27%, *SD*=15.65%) and TC (*M*=89.62%, *SD*=10.41%). No variables were found to predict TC scores. All racial groups demonstrated higher mean expectations scores than White participants. Participants reporting as African American or mixed/other had significantly higher BCI expectations than White participants (β=0.28, *p*=.030; β=0.35, *p*=.004 respectively). Early intervention experience was significantly and negatively related to BCI (β=-0.28, *p*=.010). There was no interaction between intervention experience and race/ethnicity.
Conclusions:
African American and mixed/other parents had higher expectations for intervention than White parents. Future research should not only examine factors that may influence these underlying differences, but also how these differences are related to treatment outcomes. Early intervention experience negatively predicted parents' BCI. Future research may investigate the influence of parent satisfaction with intervention, type of service, and duration on expectancies.

235 **144.235** Predictors of Parent Scaffolding in Children with Autism Spectrum Disorder

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Background: Children with autism spectrum disorder (ASD) often have externalizing (e.g., aggression) and internalizing (e.g., anxiety) emotional and behavioural problems (Ooi et al., 2011; Totsika et al., 2011). Parents can support children's emotional development through scaffolding (i.e., motivational or emotional scaffolding), which in turn may help improve psychopathology (Hooven et al., 1995; Wilson et al., 2013). Although parent scaffolding may be an important aspect of parent involvement in their children's mental health treatment, little is known about the predictors of parent scaffolding
Objectives: The purpose of this study was to investigate the predictors of parent scaffolding in children with ASD, 8 to 12 years of age. We examined both child factors (i.e., age, IQ, ASD severity, emotion regulation, psychopathology) and parent factors (i.e., emotion regulation, depression, anxiety) in relation to parent scaffolding.
Methods: Fifty-two children with ASD (89% male) and their parents (79% mothers) participated in a larger treatment trial to improve emotion regulation. Children were 8 to 12 years of age (*M*=9.63, *SD*=1.31), with average IQ (*M*=103.08, *SD*=13.57, Range=79-140). Parent scaffolding was measured using a behavioural coding scheme (Gulsrud et al., 2010), applied to parent behaviours during a standardized *Emotion Discussion Task.* We used a parent report measure (*Emotion Regulation Checklist*; Shields & Cicchetti, 1997), and two open-ended measures (*Dylan is Being Teased* and *James and the Math Test*; Attwood, 2004b) to assess child emotion regulation. Child psychopathology was measured using the *Anxiety Disorders Interview Schedule for DSM-IV* (Silverman & Albano, 1996), and via parent report on the *Behavior Assessment System for Children, Second Edition – Parent Rating Scales* (Externalizing and Internalizing subscales; Reynolds & Kamphaus, 2004). We measured parent emotion regulation using a self-report questionnaire (*Cognitive Emotion Regulation Questionnaire – Short Version*; Garnefski & Kraaij, 2006). Parent depression and anxiety was measured using the *Depression, Anxiety, and Stress Scales-21* (Lovibond & Lovibond, 1995).
Results: The majority of parents had scaffolding ratings in the "acceptable" to "good" range (*M*=3.73, *SD*=.83). Pearson correlations were conducted to examine the parent and child correlates of parent scaffolding. Of the child factors, age (*r*=-.29, *p*=.04), emotion lability and negativity (*r*=-.31, *p*=.03), and externalizing problems (*r*=-.28, *p*=.05) were correlated with parent scaffolding. Of the parent factors, depression (*r*=-.38, *p*=.007) and anxiety (*r*=-.45, *p*=.001) were correlated. The overall model accounted for 39% of the variance in parent scaffolding, $F(7,44)=3.36$, *p*=.007, and parent anxiety emerged as the only significant independent predictor (*t*=-2.64, *p*=.01).
Conclusions: This is the first study to investigate the predictors of parent scaffolding in school-age children with ASD. Parent depression and anxiety are more highly associated with parent scaffolding than child factors, suggesting that parents with better mental health are more likely to provide higher quality support of their children's emotional development. Clinicians may consider assessing the emotional needs of parents when involving parents in their children's mental health treatment.

236 **144.236** Profile of Access and Satisfaction with Health and Educational Services for People with Autism Spectrum Disorders in Latin America

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Background: People with Autism Spectrum Disorders (ASD) require multiple and different treatments throughout life and have special needs for inclusion in educational services. There is limited research available about access and level of satisfaction with these treatments in Latin America.
Objectives: Understand and analyze the access to health and education services and satisfaction with these services in families affected by ASD in order to enhance awareness, improve services and develop long term policy solutions.
Methods: This study is part of a larger one based on the needs of caregivers of people with ASD carried out in six Latin American countries (Argentina, Brazil, Chile, Uruguay, Panama, Dominican Republic) by the Red Espectro Autista Latinoamerica (REAL). Data was collected by a online survey (n=2965) during 4 months, which assessed the health and educational services that families had received, their costs (for the governments and for the families), and type of services, considering demographic characteristics by country.
Results: There are differences between countries in terms of support and treatment received by subjects with ASD. In terms of access to health services, subjects have low to moderate access, depending on the country (Language therapy 3.8-43.1%; CBT 3.8-43.2%; Neurologist 3.8-43.7%). Among all countries, language delay treatment is the most frequently received. There is a high representation of psychodynamic therapies in Argentina (30%) compared to other countries (4% Venezuela, 7% Dominican Republic). In Uruguay physical therapies (motor skills) are the most prevalent (73%), while in other countries is 30%. Some countries like Chile, Dominican Republic and Argentina have a frequency of almost 40% of Sensory Integration Therapy, while in Uruguay it is only 11%. Chile has 27% of biomedical approaches. In other countries, biomedical treatments were received in a range of 11-20%. Treatments with the lowest percentage of satisfaction in all countries were biomedical and medication. Regarding the support subjects receive in the educational setting, only Brazil reports medium to high rates (42 to 55.9%). The other countries have rates from 3 to 28.6%. Only 5.0-42.1% of parents have received training or help with their children needs or treatment.
Conclusions: There are similarities between countries in access to certain treatments, but profiles show significant differences that may be linked to the existence of different professional profiles by country and easier access of households according to socioeconomic status and level of education of parents. There is inequity in the access to educational services and support depending on socioeconomic level in all countries. These data are potentially useful for the development of human resources and health policies that promote and support access to treatment.

237 **144.237** Profiles of Parental Personal/Social Coping Resources during Children's Early School Years: Implication for Psychological Distress

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Background: Â Many parents of children with ASD experience high levels of stress and/or depression. The Conservation of Resources theory (Hobfoll, 1989) posits that people mobilize resources in the face of stressful events to maintain well-being and adjust successfully to stressors. Increased personal and coping resources enhance an individual's ability to overcome the threat of a stressor, while resource loss has the opposite effect.
Objectives: This study examined (1) patterns of personal and social coping resources among parents of children diagnosed with ASD around the time of the children's school entry; and (2) how these patterns were related to parenting stress and depression symptoms 2 years later.
Methods: Parents of 203 children from the Canadian Pathways in ASD study were included, based on availability of relevant data. At Time 1 (T1) data collection, shortly after school entry, children's mean age was 6.6 years. Parents completed a demographic survey; the Ways of Coping Scales; a Family Functioning Questionnaire; a Social Support Survey; and the Child Behavior Checklist 1.5-5. In addition, within the subsequent 12 months, parents also completed the Measure of Processes of Care to reflect their experience of family-centered care in the school system. Two years later (T2), when the children's mean age was 8.7 years, parents completed the Parenting Stress Index-Short Form and the Symptom Checklist-90-R,used to assess depression symptoms. Latent profile analysis was used to identify profiles of parents' personal and social resources at T1, with socioeconomic (SES) cumulative risk indicators, utilization of coping strategies, family functioning, social support, perception of family-centered care, and child behavior demands entered into the model. Latent GOLD's Step3 module (Vermunt & Magidson, 2013) was used to examine associations between T1 profile membership, and T2 parenting stress and parental depression.
Results: A four-profile model of parent resources showed the best fit and was also the most parsimonious (Fig. 1). Profile 1 (38%) was characterized by elevated active coping, average resources, and average child behavior demands. Profile 2 (28%) had the lowest SES risk and child behavior demands, average active coping, and elevated resources. Profile 3 (21%) displayed the lowest utilization of coping strategies, and low levels of both social resources and child behavior demands. Finally, Profile 4 (13%) had the lowest level of social resources, the highest levels of both SES risk and child behavior-related demands, and the highest level of disengaged coping strategies. At T2, profile membership significantly predicted both parenting stress and depression symptoms, $p<.001$. In particular, parents in Profile 2 reported significantly lower parenting stress and fewer depression symptoms compared to all other profiles, whereas parents in Profile 4 reported the highest symptoms.
Conclusions: Parents of children with ASD who reported low social resources, including poor family functioning, low social supports, and low levels of family-centered care, were at greater risk for experiencing later psychological distress. Professionals providing interventions to school-age children with ASD should endeavor to build collaborative relationships with families, as such relationships may help to ameliorate parenting stress and depression.

238 **144.238** Psychosocial Well-Being and Treatment Access in High Risk Families of Individuals with ASD

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Background: Research suggests that a diagnosis of ASD has a profound psychosocial impact on the entire family unit (Baker-Ericzen et al., 2005). ASD- specific social communication and behavioral impairments introduce a pervasive family stress that is maintained over a lifetime (Conway & Meyer, 2008; Hastings, 2003). While the salience may change over time, both parents and siblings of individuals with ASD are considered more vulnerable to negative psychosocial outcomes, including symptoms of anxiety and depression (Dunn et al., 2001; Tudor & Lerner, 2015). In this way, all families are at some level of risk, and are in need of individualized treatment and support. While the literature has begun to identify factors that predict family member outcome, little attention has been paid to the interaction between an ASD diagnosis and a family history of psychosocial risk. Risk may include, for example, family members with a concurrent or pre-existing psychiatric condition. Given the prevalence of these behavioral diagnoses in the general population, it is crucial for researchers and service providers to better characterize the needs of this high risk group.
Objectives: This study aims to identify 1) the psychosocial functioning of "high risk" families, 2) the treatment wants and needs of this population, and 3) factors that may contribute to further risk or difficulty accessing treatment.
Methods: Families of individuals with ASD were distributed an online survey through the Qualtrics platform. Participants in the survey were parents across the U.S. who had one child with ASD and at least one typically developing child. ASD diagnosis was confirmed by the GARS-3 (Gilliam, 1995), and typical sibling development was confirmed by parent report. Parents were also asked to rate their own psychosocial well-being (GHQ-28; Goldberg, 1978), parent stress (PSI-4-SF; Abidin, 1995), and perceived social support (ISSB; Barrera et al., 1981). Participants were also given a treatment questionnaire, inquiring about past service access, future service interest, and barriers to treatment for parents and siblings. Importantly, parents reported service access on behalf of their TD child.
Results: Of the 158 total families who completed the survey, 32 were considered to be "high risk," defined by parent endorsement of a developmental or learning disability, or major psychiatric condition in themselves or their TD child. Several group-based differences were identified between the "high risk (HR)" and "low risk (LR)" groups. Families in the HR group were significantly more diverse with regard to racial and ethnic identification. Further, these parents reported significantly lower ISSB scores and higher GARS-3 severity scores than the LR group. While parents in the overall sample reported a generally positive view of treatment services aimed at families, individuals in the HR group endorsed less service engagement in the past, and less interest in future support services than LR families. Groups also differed with regard to factors that facilitate treatment access, with the HR families citing time and financial resources as significant barriers to treatment, while these factors were not significant predictors in the LR group.
Conclusions: Implications of these differences will be discussed further.

239 **144.239** Quality of Life of Caregivers of Children with Autism Spectrum Disorders in Nigeria

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Background:
Autism Spectrum Disorder (ASD) is a disabling neuro-developmental disorder. In resource-poor countries with dearth of specialised services and formal support for children with disabilities, informal caregivers have little or no respite in caring for children with ASD. The impact of caring for a child with ASD may negatively impact the mental health and quality of life of caregivers, which may subsequently jeopardise the continuity of informal care available for children with ASD. Since, the well being of the informal caregiver is inextricably linked to that of the child with ASD, it is pertinent to determine the mental health of the caregivers, in order to inform relevant interventions.
Objectives:
1. To assess the Quality of life of informal caregivers of children with ASD.
2. To compare the QOL of the caregivers with that of a control group, matched for age and gender
3. To determine the correlates of Quality of life and depression among the study group
Methods:
The study group consisted of caregivers (n=42) of children with ASD attending a tertiary mental health care facility in Lagos, Nigeria. The control group consist of age and gender matched individuals from the same community who were involved in caring for children without chronic disease. The study instruments consisted of a socio-demographic questionnaire, World Health Organisation Quality of Life Questionnaire Brief form (WHOQOL- Bref), Mini International Neuropsychiatric Interview (MINI version 5.0) and the Oslo-3 Support Scale (OSS-3). Qualify of life (QOL) of the participants was assessed across four domains namely physical health, psychological health, social relationships and environment. Participants were assessed for depression using the MINI. The level of social supports available to the caregiver was determined using the OSS-3. The data was analysed using SPSS-IBM version 20.
Results: The majority (76.2%) of the caregivers were females, and 61.9% were mothers of the children with ASD. More than half (54.8%) of caregivers reported quitting their jobs due to the demands of care-giving. None of the caregivers had any form of formal social or financial welfare support outside the family. Nearly half (47.6%) of the caregivers rated the support received within the family as poor. Caregivers of children with ASD had significantly poorer overall Quality of life scores in comparison with the control group (t=2.089, p=0.041).Â Quality of life of the caregivers was also significantly lower in the psychological domain (t= 3.233, p=0.002) and environmental domain of WHOQOL-Bref (t=4.032, p=<0.001). Caregivers who had to quit their jobs to care for children with ASD reported significantly lower QOL in the physical domain (t=2.168, p=0.036) and social relationships domain (t=5.475, p=0.008). Caregivers had higher prevalence of depression (23.8%) compared with 14.2% in the control group (p=0.266). Caregivers with poorer quality of life were more likely to be depressed (p<0.005). Caregivers with depression reported lower levels of social support (p<0.005).
Conclusions: The findings highlights the need for formal support and other interventions targeted at improving the quality of life and addressing the mental health needs of caregivers of children with ASD.

240 **144.240** Quality of Life of Parents of Children with ASD: From Adolescence to Early Adulthood.

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Background: Autism spectrum disorders (ASD) are lifelong disorders, potentially impacting the parental quality of life (QoL) in a persistent manner. The transition period from adolescence to adulthood has been reported as a time of confusion and stress for families of people with developmental disabilities. When entering adulthood, most people with ASD still need a consequent support in their daily life and parents have to face significant life adjustments such as finding new services and a place of living for their child with ASD. However, there are very few studies about the transition from adolescence to adulthood in ASD and its impact on parental QoL.
Objectives: The goals of this study were to describe parental QoL in the EpiTED cohort and its related risk factors at early adulthood. We also examined the determinants and predictors of QoL in the subgroup of parents who experienced an improvement or a decline in their QoL from adolescence to adulthood ASD and its impact on parental QoL.
Methods: One hundred and six mothers or fathers of young adults with ASD completed the Par-DD-QoL scale at two time points: during adolescence (mean age = 15 years) and young adulthood (mean age = 20 years). This scale assesses the following dimensions: emotional, daily disturbance and global QoL. Adaptive skills, aberrant behaviors, symptom severity, as well as environmental variables (social support, type of interventions, scholarship) were also assessed at the two collection time points. This cross sectional study uses a subset of data collected at the last two times of a follow-up study (EpiTED cohort).
Results: Â Results show that parental QoL is altered or moderately altered in two third of parents, suggesting that the impact of ASD on families remains strong even when children become adults. The perceived impact of ASD on parental QoL at adulthood was related to their children's characteristics, namely the level of adaptive skills, the severity of symptomatology and the presence of challenging behaviors. The polytomic regression demonstrated that challenging behaviors were the main risk factors for a decreased parental QoL, particularly the lethargy/withdrawal, irritability, and hyperactivity domains. Among the 106 parents, 54 experienced a gain or a loss in their global QoL over the 5 years period. Results showed that parents whose children had a decrease in challenging behaviors experienced a gain in their QoL, suggesting that, when entering adulthood, challenging behaviors are the strongest predictor of parental QoL. Another interesting result is that parents who experienced a gain in their QoL were more likely to be members of a parental association, which is a substantial form of social support.
Conclusions: Overall, the changes in parental QoL from adolescence to adulthood were mainly predicted by the presence of challenging behaviors in their children and the social support they can find. These results argue for the importance to propose specific interventions to target associated challenging behaviors in ASD and to provide social support to families.

241 **144.241** Relation Between Socioeconomic Status and Symptom Severity, Cognitive, and Language Ability in ASD

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Background: The factors associated with low socioeconomic status (SES) are known to have negative impacts on language and cognitive development (Hart & Risley, 1995). While the negative effects of poverty on typical development have been widely documented, little is known about how socioeconomic factors may influence developmental outcomes in children with ASD. There is some evidence that low SES is associated with later age of diagnosis and reduced access to intervention services in ASD (Dickerson et al., 2016). Examining the relationship between SES and developmental outcomes in ASD is critical for understanding the impact of socio-contextual factors on symptom presentation in ASD. Knowledge thereof also has the potential to inform intervention efforts in vulnerable populations.
Objectives: To investigate the relationship between SES, cognitive ability, and ASD symptomatology in a cohort of children and adolescents with ASD taking part in brain imaging studies.
Methods: 96 participants (80 males) ages 7 – 18 (mean ±SD = 13.6 ± 2.7) with confirmed ASD diagnoses completed neuropsychological and diagnostic assessment as part of an ongoing study of brain development and ASD. Participants completed the CELF-4, WASI-II, ADOS-2 and the ADI-R. Additionally, primary caregivers of 37 participants (30 males) provided information on both maternal and paternal income and education level. SES variables were submitted to Principal Component Analysis (PCA), which yielded two principal components (PCs) accounting for 49% and 28% of the variance, respectively. PC1 and PC2 were then used as predictors in multiple linear regression models to test for associations between SES, ASD symptomatology, and cognitive ability.
Results: Maternal income and education both loaded positively onto PC1 (rs = 0.88 and 0.44, respectively), whereas paternal education loaded positively onto PC2 (r = 0.80). Thus, PC1 and PC2 were interpreted to represent maternal SES and paternal education, respectively. Consistent with previous findings on the effects of maternal SES factors on language ability, maternal SES (PC1) was significantly associated with language skills (r = 0.47, ß = 4.41, t_{22} = 2.52, p = 0.02), and cognitive ability (r = 0.43, ß = 4.04, t_{29} = 2.56, p = 0.01) (see Figure 1). Notably, PC1 scores were negatively associated with ASD symptom severity on the ADI-R (r = -0.41, ß =Â -1.64, t_{28} = -2.38, p = 0.02) (see Figure 1). Paternal SES factors were not associated with any outcome measures.
Conclusions: Â Consistent with findings in the general population, we found that lower maternal income and education were associated with lower cognitive ability and weaker language skills in children and adolescents with ASD. Lower maternal SES was associated with increased symptom severity on the ADI-R, a parent report of the child's symptoms at age 4-5 years. Intriguingly, this association was not significant on the ADOS-2, a clinician-rated measure. This discrepancy merits further research on the use of parent-report and clinician-rated diagnostic tools in low-SES populations. Paternal SES factors were not associated with any clinical or cognitive outcomes, corroborating previous findings that maternal SES factors have a greater effect on developmental outcomes than paternal factors.

242 **144.242** Results of a Patient-Centered Outcomes Research Institute (PCORI) Approach to Engaging ASD Stakeholders in Rural Underserved Areas

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Background: The Patient Centered Outcome Institute (PCORI) has identified the critical need to address health disparities that exist among patients and connect researchers with stakeholders to focus on what is most important to patients and their families. Building on our initial work with families of children with Autism Spectrum Disorders (ASD), we have been awarded two PCORI grants (Tier 1 and II) to engage and build capacity for families and other stakeholders living in rural areas who are more likely to have reduced access to proper care and use alternative, unproven, and potentially harmful treatments.
Objectives: To describe the 2-tiered process of implementing the PCORI mechanism and report stakeholder generated comparative effectiveness research priorities related to families of individuals with ASD living in underserved rural areas
Methods: In 2014 our team was funded by the Clinical Translational Research Institute ar our university to establish a Community Advisory Board (CAB) of major stakeholders (e.g., parents of individuals with ASD, community-based healthcare service providers, school teachers) and we conducted a series of focus groups. Results from this study informed two subsequent PCORI funded applications (Tier I and II, 2015-2017), the second of which is currently in progress. This work demonstrates how the PCORI mechanism can be implemented in a systematic manner to engage stakeholders in rural underserved areas and position researchers to conduct comparative effectiveness research studies that are of most interest to the stakeholders.
Results: Following the completion of the initial study that engaged focus group participants to identify barriers to early diagnosis and treatment, we have greatly increased our capacity to reach and engage stakeholders in three rural underserved areas of our state. These vibrant and highly engaged groups are led by community stakeholders and include parents, educators, and community service providers who meet monthly in their rural locations. The group leaders also meet monthly with our centrally located Community Advisory Board (CAB) to discuss their progress and receive professional consultation as needed. These groups have each established their own names, functions, and priorities that will, in the spirit of PCORI, inform subsequent comparative effective research that is most meaningful to them. While several topics have emerged, of most interest is future research evaluating the effects of distance delivered ABA, PRT interventions and remote data capture using state of the art technology
Conclusions: Â As noted, the Patient Centered Outcome Institute (PCORI) approach is well-suited to address the needs of underserved and rural ASD stakeholders. Engaging stakeholders from the beginning of the research process (i.e., formulating the comparative effectiveness research questions) is critically important to remove "the mystique" that stakeholders may perceive related to autism research and facilitate their involvement throughout the process of conducting comparative effectiveness studies.

243 **144.243** Role of Externalizing Children Problem Behaviors in the Relationship between Autism and Parenting Stress: A Primary School Based Case-Control Study

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Background: Identifying the sources of parenting stress (PS) is important to improve well being of parents and their child. Although PS has been consistently reported higher among parents of children with autism spectrum disorders (ASD) than parents of typically developing (TD) children, the findings of the relationship between severity of ASD and PS among parents of children with ASD are not consistent suggesting PS can be independent from ASD. While children problem behaviors (CPB) are known to be a major source of PS, little is known about the relationship between ASD, CPB, and PS.
Objectives: (1) To compare PS between parents of children with ASD and TD children; (2) To examine factors associated with PS; and (3) To examine the role of CPB, including externalizing and internalizing problem behaviors, in the relationship between the symptoms and severity of ASD and PS.
Methods: A cross-sectional survey was conducted in 5 public primary schools and 2 special education programs in 2015. A total of 731 parents (177 ASD children and 554 TD) completed the survey (M=41.5 years old, SD=6.4). Age by gender of children was matched between the children with ASD and TD children groups (M=8.6 years old, SD=1.6). The measures included parent and child characteristics, Childhood Autism Spectrum Test (CAST) assessing symptoms and severity of autism characteristics, Strengths and Difficulties Questionnaire (SDQ) assessing externalizing and internalizing CPB, pro-social behavior, and parenting stress (PS; the Parental Distress subscale of Parenting Stress Index Short Form). Pilot survey checked preliminary validity and reliability in the study sample. Multiple regression models were used to examine the associations between the study variables and outcome variable of PS, direct and indirect effects of CAST on PS mediated by SDQ, controlling for diagnosis of ASD (i.e., children with ASD and TD children groups).
Results: Compared to parents of TD children, those of children with ASD reported higher scores on CAST, externalizing and internalizing CPB, and PS and lower score on pro-social behavior (all p<.001). In multiple regression models, in the sample of ASD cases, PS was significantly associated with the number of children with ASD, externalizing CPB and less pro-social behaviors. In TD controls, PS was significantly associated with lower household income, larger household size, lower birth order, externalizing and internalizing CBP. The significant indirect effect was found between CAST and PS, mediated by SDQ in both groups: .34* (.12) in ASD case and .50***(.066) in TD control. In examining the both groups in one model, the effect of externalizing CPB was found as well: .42***(.081), and diagnosis of ASD entered but was not significant for PS.
Conclusions: The mediation effect of CPB on the association between CAST and PS suggests a primary stress source for PS was not the severity and symptoms of ASD but externalizing problem behaviors. Children's labeling with ASD was not a primary parenting stressor either. Psychological interventions should focus on skills and efficacy in coping with their children's externalizing behaviors rather than autism-oriented characteristics in order to alleviate PS.

244 **144.244** Should We Tell? Parents' Perspectives on Disclosing an Autism Diagnosis

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Background: Deciding to disclose their child'sÂ diagnosis of autism spectrum disorder (ASD) to others is a major life decision for parents. Limited research has investigated the implications of disclosure or non-disclosure, leaving families without evidence to help guide or inform their decision-making processes. It also leaves professionals, to whom parents often turn for advice and support, with little evidence to inform their recommendations to families.
Objectives: Â To better understand: (1) The decision-making processes by which parents of a child diagnosed with ASD chose to disclose their child's diagnosis to others; for example, family, peers, educators, healthcare professionals, and community members. We explored decision-making related to if, to whom, when, how, and why parents choose to disclose, or not disclose. (2) Parents' perspectives of the outcomes of disclosure or non-disclosure.
Methods: Using a constructivist grounded theory methodological approach (Charmaz, 2006), we interviewed parents of 3-16 year old children with ASD (N=10 to date). Purposive and theoretical sampling were used for diversity in child and family factors (e.g., age, symptom severity, ethnicity), and families who have chosen to disclose and not disclose. Recruitment, data collection and analysis will continue until saturation. Consistent with grounded theory methodology, data collection and analysis are being conducted concurrently to inform theoretical sampling, emerging codes, and the development of theoretical categories. Data, consisting of verbatim transcripts, field notes, and memos, are being analyzed using constant comparative analysis and initial, focused, and theoretical coding strategies (Charmaz, 2006).
Results: Based on preliminary data analysis, decisions to disclose were related to parent's acceptance of the ASD diagnosis, their perceived knowledge about ASD, their perceptions of stigma and blame, and parent's desire for informal and formal supports. Perceived disadvantages of disclosure included reluctance to have their child labeled, especially when young, concern about a lack of control over who the child's diagnosis may be shared with once disclosed, and fear of stigmatization and blame by spouses, relatives, and society in general. Benefits of disclosure included increased safety of their child and others, parent social support, affirmation of concerns about their child, and access to funding and services. However, some parent's felt that disclosure was a necessity, not a choice, to access funding and services.
Conclusions: These analyses will be used to generate a theoretical model representing the decision-making processes of disclosure, including parents' perceived decision making points and outcomes. Findings may help increase sensitivity and understanding, and decreasing stigma and judgment for professionals and the public, related to parents' decisions of whether or not to disclose their child's diagnosis of ASD.
Charmaz, K. (2006). *Constructing Grounded Theory*. London: Sage.

245 **144.245** Sibling Status (TD or ASD) Is Associated with Parent Reports of Adaptive Skills in Children with ASD

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Background: Previous research has focused on the impact of having a sibling with autism spectrum disorder (ASD) on typically developing (TD) children. Findings suggest that having an ASD sibling is associated with increased adjustment problems, peer problems, internalizing and externalizing behaviours and less prosocial behaviour in TD children (Hastings, 2003; Ozonoff et al., 2010). However, little research exists on how the effect siblings have on the behaviour of children with ASD. In the current study we examined adaptive skills of children with ASD who had a TD sibling vs. a sibling with ASD. Children with ASD generally show poor adaptive skills (Gillberg, 2002), even those with average intellectual functioning show adaptive behaviour in the "at risk" range (Volker et al., 2010). In this study we assessed adaptive skills including adaptability, social skills, leadership, activities of daily living, and functional communication in children with ASD who had a TD sibling and inthose who had an ASD sibling.
Objectives: To investigate whether sibling status (i.e., TD or ASD) is associated with different levels of adaptive skills in children with ASD
Methods: Â Participants were 40 children with ASD between the ages of 6 and 17 years old (*M*=11.4; SD=2.4) who have one sibling (agerange = 6–21 years; M=12.1; SD=2.4) with ASD (n=12), or one TD sibling (n=27). The parents ratedtheir children's adaptive skills on the Behaviour Assessment System for Children Second Edition (BASC-2), and ASD symptoms on the Social Responsiveness Scale (SRS). Children's IQ scores were assessed using the Wechsler Abbreviated Scale of Intelligence (WASI-II), or Stanford-Binet Intelligence Scales, abbreviated version (SB5).
Results: Â Hierarchical multiple linear regression analyses indicated that sibling status was a significant predictor of Adaptive Skills in children with ASD, above and beyond ASD symptoms, IQ, siblings age, and participants age. Specifically, having a TD sibling accounted for a significant additional 19% of the variance in adaptive skills (.To further explore this relationship we examined the subscales of the Adaptive Skills. Certain subscales remained significant, Adaptability(, Activities of Daily Living (,and Functional Communication (. In contrast, social skills and leadership subscales did not reach significance.
Conclusions: In children with ASD, having a TD sibling is a significant predictor of higher scores on Adaptive Skills including Adaptability, Activities of Daily Living and Functional Communication. These results suggest that TD siblings may have an important role to play in the daily functioning of children with ASD. Having a TD sibling may provide opportunities for modeling of adaptive behaviour in children with ASD and sibling mediated interventionsmay be a potentially powerful tool for teaching adaptive skills to children with ASD.

246 **144.246** Sleep Problems in Children with Autism Spectrum Disorders: Impact on Caregiver Quality of Life.

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Background:
Children with autism spectrum disorder (ASD) frequently experience sleep problems, with previous research indicating prevalence rates of between 50 to 80%. Due to the negative impact of prolonged sleep problems on developmental outcomes and general health and wellbeing, this is a major cause for concern. Research suggests that sleep problems in children with ASD also have a wider negative impact on their caregivers, particularly in relation to parent stress. The relationship to the phenomenon of parent quality of life (QOL) however has not been explored; despite literature finding associations between parental QOL and behavioural problems in children with ASD, the impact of child sleep has not been explicitly investigated.
Objectives:
The study aimed to establish a profile of sleep problems in children with ASD in a Western Australian population, and subsequently examine the relationship between sleep problems in children with ASD and parent QOL, with consideration of the impact of other child factors.
Methods:
A cross-sectional survey was conducted with 204 caregivers of 219 children with ASD aged 2-18 years living in Western Australia, with data collected over an 18-month period from January 2015-July 2016. Outcome measures were all parent-reported and included the Children's Sleep Habits Questionnaire (CSHQ), World Health Organisation Quality of Life (WHOQOL) - BREF version, the DSM-IV-TR/ICD-10 checklist of ASD diagnostic criteria, and general demographic questions. A sleep profile was generated based on established 'cut offs' indicative of clinically significant sleep problems. General linear modelling was conducted to examine the presence of a relationship between parent QOL and child factors, including sleep problems.
Results:
Results from the CSHQ indicated that over 85% of the children experience clinically significant sleep problems. Key areas of concern were poor sleep duration, sleep onset delay, night wakings and parasomnias. Sleep problems were found to be significant predictors for two of the three QOL domains. Sleep-disordered breathing, daytime sleepiness and sleep duration were found to be predictors of poorer parental physical QOL, while bedtime resistance predicted poorer social relationships QOL. Sleep was not a significant predictor of parent psychological QOL. Other significant child factors included communication difficulties, sensitivity to sensory input, behaviours relating to distress over environmental change, and taking melatonin supplements (a common sleep intervention). Factors of child age, gender, diagnosis, and presence of other co-morbidities were not significant predictors.
Conclusions:
Findings confirm the high presence of sleep problems in a sample of Western Australian children with ASD, highlighting the need for greater clinical attention including assessment and intervention of sleep problems in this population. The presence of significant relationships between child sleep problems and parent QOL demonstrates the significant negative impact these problems have, not only on the child, but on their caregivers. This emphasises the need to consider the family as a unit in paediatric clinical practice, and draws attention to the need for recommendations to be considered on the basis of effectiveness for the child, as well as whole-of-family feasibility and 'fit'.

247 **144.247** Stigma and Social Perception of Mothers of Children with Autism Spectrum Disorder

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Background:
Mothers of children with autism spectrum disorder (ASD) report higher levels of parental stress related to community responses to their children's behavior and their parenting strategies. These experiences may contribute to high levels of anxiety and depression that have been reported in mothers of children with ASD. Stigmatized individuals "possess a quality that others perceive as negative, unfavorable, or in some way unacceptable" (Shtayermman, 2009). Goffman (1963) first used the expression "courtesy stigma" to describe the distinctive burden of association with a stigmatized individual. Mothers of children with ASD, in the role of primary caregivers, are especially vulnerable to stigmatizing behavior in their community (Nealy, 2012). Characterizing mothers' experience of stigma is critical, as experiences of prejudice, rejection, and discrimination increase the risk for psychopathologies such as anxiety and depression (Farrugia, 2009).
Objectives:
We aimed to understand mothers' experiences of stigmatization associated with raising one or more children with ASD. Using a qualitative approach, we examined two different types of courtesy stigma: (1) Felt Stigma (feelings of shame or rejection) and (2) Enacted Stigma (overt acts of discrimination) triggered by mothers' peer groups, families, or strangers. We also examined whether mothers developed coping mechanisms to counteract these acts of stigma.
Methods:
We conducted in-depth, semi-structured interviews (lasting 27-83 min) with 20 mothers with at least one child with ASD (age range: 3-10 years). Mothers were asked about experiences related to raising children with ASD, including quality of the relationship between their children and shifts in family dynamics after receiving an ASD diagnosis.Â Interviews were transcribed and double coded for accuracy, and a codebook consisting of 60 codes was established using a thematic analysis approach (Braun & Clark, 2006). We focused on the following three sub-themes: (1) Mother's Feelings of Shame (2) Invisibility of ASD and (3) Misconceptions of ASD, to identify instances of enacted and felt stigma.
Results:
All 20 participants reported personal accounts of distinct challenges related to parenting a child with ASD. Effects of felt stigma were reported by 80% of mothers.Â The fact that ASD is not overtly recognizable made it harder for parents to connect with friends and family, and in some cases, led to the destruction of relationships. Cases of enacted stigma, endorsed by 30% of mothers, were experienced through categorization by use of labels and negative judgment regarding parental decisions.Â One mother reported excommunication from her church congregation due to her child being disruptive during services. Generally, effects of courtesy stigma are negative. Still, mothers developed coping styles that allowed them to view stigmatizing reactions of others as acts of ignorance, rather than malice.
Conclusions:
Courtesy stigma is conveyed in public reactions to mothers' parenting choices and has damaging effects on social relationships and well-being. Mothers' coping strategies are self-protective and they also safeguard the family unit by defending against critical judgments about the child and the family. Further exploration of courtesy stigma will consider if severity of a child's symptomatology is related to the degree of stigma that a family experiences.

248 **144.248** Strategies for Successful Dental Encounters for Children with ASD: A Qualitative Study

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Background: It is well established that oral care is an important component of pediatric healthcare. Many barriers to treatment have been identified for the ASD population, but few high-quality interventions have been designed and implemented to improve care for this population.
Objectives: As the prevalence of ASD increases, dentists are increasingly more likely to encounter children with ASD in their practice. Therefore, the purpose of this study was to gather information on the current strategies implemented by dental professionals and by parents of children with ASD to facilitate successful oral care encounters.
Methods: To document dental practitioner and parent strategies utilized to facilitate oral care challenges in the dental office and home four focus groups were conducted, two with parents of children 5-18 years with ASD and two with dental practitioners who treat children with ASD. Each focus group lasted 2.5-3 hours in duration and were transcribed verbatim. Thematic analysis following a grounded theory approach was used to describe parent and dentist implemented strategies to address children's oral care challenges.
Results: In the parent focus groups, three themes emerged. The first theme, *What Makes a Good Dentist*, focused on dentist knowledge, understanding and experience, which were all reported to be essential to a positive dental care encounter. The second theme, *Tricks, Tactics, and Diversions,* described different techniques and strategies the dental practitioner could use to help make dental visits successful. These included: (1) the strategic use of scheduling for visits, (2) the coordination with other professionals, (3) the implementation of adaptations as needed, (4) the search for sugar bugs, (5) the use of positive reinforcement, (6) the creation of a child- and sensory-friendly dental environment, and (7) the utilization of drugs. The last theme, *Preparation, Preparation, Preparation,* explored strategies caregivers could implement to increase the chance of a successful dental encounter including: (1) how to "warn" the child about the visit, (2) how to practice for the dental visit, (3) how to use visual schedules and/or social stories, and (4) items to bring to the dental visit.
Dentist focus group data analysis is currently in progress.
Conclusions: Parent findings provide insight into the techniques perceived to lead to successful dental care encounters for children with ASD. Combined with the perspectives of dental care practitioners, this information has the potential to improve care for this population by identifying areas for accommodation to create the optimal experience for children with ASD and their parents.

249 **144.249** Support Intensity Scale Profile in Autism : A Proof of Concept Study

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Background:
Tailoring supports for individual needs in disability requires tools that reliably and validly measure those needs. That is the function of the Supports Intensity Scale for children (SIS-C) developed from the American Association on Intellectual and Developmental Disabilities. SIS-C measures the individual's support needs in personal, work-related and social activitiesÂ in order to identify and describe the types and intensity of the support an individual requires. SIS has been designed to be part of person-centered planning processes that help all individuals identify their unique preferences, skills and life goals.
Objectives:
The aim of the study is to assess the SIS-C profile in Autism in comparison withÂ Intellectual and Developmental Disability (IDD) not related to autism.
Methods:
We have applied the Italian Version of SIS, during the process of Italian psychometric validation, to a group of children and adolescents with different kinds of neuropsychiatric disorders in a multicenter study carried out in13 units throughout the Italian territory. This paperÂ presents the data concerning two specifics subgroup of 127 individuals with autism (mean age 9.76; range 4-17 years) and 62 persons with IDD not related to autism (mean age 11.33; range 5 – 16 years). Seven support need dominions have been explored through independently structured interviews, whereby the two principal caregivers for each subject in this study responded to a total of 61 items covering: home living, community and neighborhood, scholastic participation and learning, health and safety as well as social and advocacy activities. Results are expressed as a percentage of maximum theoretic support need in each dominion.
Results:
The score profiles obtained from the interview of two caregivers resulted highly correlated in all dominions of the scale (*r* values ranging from 0.85 to 0.95). Individuals with AUTISM, despite an average level of intellectual disability similar to that individuals without autism diagnosis showed degrees of support need that were significantly higher than subjects in the comparison group for all dominions (see figure 1), with absolute differences ranging from +33% to +61% (mean +42%). As expected, the difference was particularly evident for home living, social activity, and community and neighborhood dominions.
Conclusions:
Traditionally, a person's level of developmental disability has been measured by the skills the individual lacks. SIS-C shifts the focus from shortfalls to needs. The scale evaluates practical support people with developmental disabilities need to lead independent lives. The key message emerging from our study is that, given a similar level of intellectual function, special needs in individuals with AUTISM are around 40% higher than those in subjects with IDD not associated to autism.

250 **144.250** Teacher Self-Efficacy for Teaching Students with Autism Spectrum Disorder: A Study of Relationships with Stress, Engagement, and Student Outcomes

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Background: Â Teacher self-efficacy refers to the belief teachers hold about their ability to affect student learning (Bandura, 1997; Klassen, Tze, Betts, & Gordon, 2011) and has been shown to change teachers' motivation and work effort (Klassen & Chiu, 2010). Teachers' sense of their own efficacy (i.e., effectiveness as teachers) varies according to the diverse contexts and learners they face, however, little research has examined efficacy when teaching students with autism spectrum disorder (ASD; Ruble, Toland, Birdwhistell, McGrew, & Usher, 2013). White, Smith, Smith, and Stodden (2012) noted that ASD learners have become one of the most challenging groups to teach; therefore, investigating the interpersonal processes involved in teaching children with ASD is an important and relevant area of research. This study seeks to explore the potential associations between self-efficacy and related constructs using multiple measurement techniques and sources (i.e., observational data, self-report, and outside observer). By incorporating objective behavioral measures and not simply self-report, teacher self-efficacy can be considered in relation to student outcomes and achievement.
Objectives: This study investigated relationships among teacher self-efficacy for teaching students with ASD and linked variables including teacher stress, student outcomes, and teacher engagement.
Methods: Special education teachers (*N* = 44) were recruited as part of a larger randomized controlled study examining a consultation intervention with teachers of students with ASD. Data were collected over multiple time points, but this study focused solely on the final responses. Measures included a self-report instrument assessing teacher self-efficacy for teaching students with ASD (ASSET) and a standardized self-report instrument capturing teacher stress, the Index of Teaching Stress (ITS). In addition, blind observers reported on a measure of teacher engagement. Student achievement data was collected using direct videotape observation from an unaware rater using goal attainment scaling. Correlation analyses were used to determine the initial degree of relationships between the variables of interest.
Results: As predicted, scores from the ASSET were positively related to teacher engagement ($r = .36$, $p < .05$) and student achievement ($r = .39$, $p < .01$). This signals a degree of relationship between teachers who engage positively with their students with ASD and teachers who self-report higher levels of teacher self-efficacy. In addition, ASSET scores were negatively related to scores derived from the measure of teacher stress ($r = -.39$, $p < .01$), indicating that teachers who have low self-efficacy for teaching students with ASD also report higher levels of stress.
Conclusions: Teacher self-efficacy was positively related to indicators of good teaching quality (higher engagement and student outcomes) and protective against negative teacher outcomes (stress). Teacher self-beliefs are likely to have significant impact on teachers' decisions, teaching environment, and interactions with students. The results have potential applications in making professional development decisions, addressing areas of perceived incompetence, and improving teacher practice.

251 **144.251** The Autism Family Experience Questionnaire (AFEQ): An Ecologically-Valid, Parent-Nominated Measure of Family Experience of Autism, Quality of Life, and Prioritised Outcomes for Early Autism Interventions

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Background:
A focus on patient-centred outcomes, such as quality of life (QoL), has become increasingly important to intervention research. Simultaneously, there has been increasing attention to user involvement in research design. Families of children with ASD have an important contribution to make in defining the metrics by which successful interventions are judged.
The Pre-school Autism Communication Trial (PACT) was a randomised controlled trial of a parent-mediated communication-focussed intervention for pre-schoolers with autism and their parents (Green et al., 2010), with an endpoint (1-year) and 5-year follow-up.
Objectives:
1) To consult with families to develop a parent-generated measure, the Autism Family Experience Questionnaire (AFEQ), which would reflect family experience of autism, quality of life, and family priorities for specific areas that might be changed by an effective intervention
2) Within the PACT trial, to check the external validity of the child development aspects of the AFEQ by testing for a strong association with the parent rated Vineland Adaptive Behavior Scales (VABS; Sparrow et al 2006);
3) To examine a treatment effect in the AFEQ, with the hypothesis that, compared to controls, the PACT intervention group would show relative improvements in the total AFEQ score and each of the subscale scores, at endpoint (1-year) and 5-year follow-up
Methods:
The AFEQ was developed from focus groups and a national web-based consultation which asked families of young children with autism to nominate key markers of an effective pre-school autism treatment. The AFEQ was then administered at baseline and follow-up to the 152 families involved in the PACT trial.
Results:
1) The AFEQ was developed from focus-group themes and consultation feedback. It contains 56 items and covers three domains: 1) experience of parenting their child; 2) quality of family life; 3) child development, social functioning and behaviour.
2) There were strong correlations between the AFEQ child development subscore and the VABS total score: baseline r = -0.46 ($p<0.001$, n=143); endpoint r = -0.57 ($p<0.001$, n=134; AFEQ low score = better outcome, VABS high score = better outcome).
3) We compared AFEQ total and subtotal scores between intervention and control groups using linear regression (analysis of covariance) including baseline measures of the outcome as a covariate. Summary statistics and treatment effect estimates are presented in the table. On the AFEQ total score, there was a statistically significant improvement of PACT over controls. Treatment effects on the AFEQ subscales were all non-significant, although showing a trend towards a more positive outcome for the intervention group. Findings from the 5-year follow-up data will also be presented.
Conclusions:
The AFEQ represents a viable, ecologically valid, parent-nominated measure of prioritised outcomes for a pre-school autism intervention. It shows association in the expected way with another parent rated measure, the VABS. It also shows evidence of sensitivity to change over time: a treatment effect in response to a parent-mediated intervention for autism. The AFEQ has the potential to enhance understanding of the external validity of early psycho-social interventions for children with autism.

252 **144.252** The Colorado Parent Mentoring Program: Parent-to-Parent Support Improves Family Functioning and Satisfaction with Care

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Background: Despite the increasing prevalence of autism (Baio, 2014) there is currently no standard of care for autism and systems of care remain highly fractured. The challenge of creating, financing, and maintaining treatment plans adds to the stress experienced by families of children with autism. As mothers are often designated as the caregiver for children with autism, much of this burden falls on them (Bouma & Schweitzer, 1990). Previous research has found that mothers and fathers deal with the stress associated with having a child with autism differently, with social support being key for mothers (Boyd, 2002). The Colorado Parent Mentoring (CPM) program was created to improve family quality of life, family functioning, and service use, as well as to help create social support networks for mothers of children with autism. CPM combines family centered action planning and education with ongoing parent-to-parent mentorship.
Objectives: This study was designed to measure family functioning and quality of life, service use, social support, and program acceptability outcomes of the CMP program for families of children newly diagnosed with autism.
Methods: In a randomized controlled trial, the CPM intervention was given to a group of parents (n=29) and compared to a waitlist group (n=32) on four main outcomes: 1) family quality of life (Family Quality of Life questionnaire; FQOL), 2) family functioning (Family Adaptation and Cohesion Scale IV; FACES), 3) service use, and 4) program acceptability. Qualitative interviews were also conducted with all participants to explore program benefits to social support.
Results: Linear mixed models were used to test the effect of group (active vs waitlist), time (pre vs post). The active group reported greater satisfaction with disability related supports following intervention (FQOL; t = 2.18, p=.03) and reduced family rigidity (FACES, t=2.15, p=.04). Services used outside of the school setting increased for all participants but did not meet the national standard; the program was highly acceptable to participants. Qualitative data suggest that once mothers were connected to other mothers, they experienced a sense of empowerment, which reduced stressful interactions with family members.
Conclusions: The CPM program prevented rigidity in the family system and reduced the level of importance parents held regarding involvement of other family members in their child's care.Â Family functioning and quality of life are complex following a child's diagnosis of autism. The CPM program positively impacts family functioning and quality of life, primarily due to the increased social support created through this program for mothers.

253 **144.253** The Development of a Family Support Package for Parents Following a Child's Diagnosis of Autism Spectrum Disorder: What Do Parents Want?

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Background: Â Children with ASD are being diagnosed more than ever before. Unfortunately, the diagnostic process is distressing and difficult to understand for families.
Objectives: Â The objective in the proposed project is to develop and test the efficacy of a Family Support Package (FSP) to support parents soon after the diagnostic process.Â The specific aims include: 1) the development of a package that comprises parental education/information in the form of a post-diagnostic kit, and a Family Clinic (FC); 2) to investigate whether access to the FC improves parental well-being.
Methods: Â Focus groups were conducted with parents to inform the development of the FSP.Â This paper will present the qualitative results from the focus groups and the framework of the FSP.
Results: Â Mothers and fathers who received their child's diagnosis in the last 24 months were invited from the participant registry to the current study. Consenting participants attended a single focus group of approximately 60 to 90 minutes with four to six other parents. Audio recordings were transcribed with qualitative analyses conducted to draw key themes.
Conclusions: Parents of children diagnosed with ASD at a young age are often overwhelmed and uncertain about what to do at this critical time. Themes emerged from the focus groups that identified what parents really want and what is most helpful to them soon after the diagnosis. A central contact point was highlighted, as well as a step-by-step guide about who to contact and where to find more information. Parents also emphasised that education and awareness of ASD is key to their understanding and acceptance of the diagnosis.

254 **144.254** The Effect of Sibling Order on Communication in Individuals with and without ASD

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Background: Sibling interaction can be an important positive influence in the development of children with autism spectrum disorder (ASD; Jones & Carr, 2004; Knott et al., 2007). Social and communication difficulties are core components of ASD, with deficits in adaptive use of language being common. A recent study indicated that children with ASD who had at least one older sibling showed stronger communication skills than children with ASD who did not have siblings (Ben-Itzchak et al., 2016), suggesting that older siblings promote social interaction and foster the acquisition of communication in children with ASD. It is not known whether the influence of sibling order on communication and adaptive use of language is specific to ASD or common to other neurodevelopmental disorders.
Objectives: The present study evaluated whether sibling order has an impact on the adaptive use of language in individuals with ASD when compared to individuals with diagnoses other than autism.
Methods: The present study utilized a clinical sample of 25 individuals (Mean age: 8.62, Range: 3-25); data collection and retrospective analyses of additional historical cases are ongoing. Seventeen individuals had an ASD diagnosis (Mean age: 7.76, Range: 3-19; diagnosis confirmed with ADOS). Eight of the seventeen individuals in the ASD cohort were oldest children. The eight individuals who did not meet criteria for ASD (Mean age: 10.43, Range: 4-25) had other clinical diagnoses (e.g., anxiety, language disorder), as evaluated by a multi-disciplinary team. Four of the eight individuals with other diagnoses were oldest children. The Vineland II Adaptive Behavior Scales – Survey Interview (VABS-II) was administered to parents, and the communication domain was used to evaluate each subject's adaptive use of language.
Results: Â T-tests revealed no significant differences in the adaptive use of communication (VABS-II) between individuals with ASD and other psychological conditions (p=.945). In the ASD group, there was a marginal effect (p=.057) with regard to sibling order, such that those who were the oldest children in their families had higher communication standard scores, thus demonstrating greater adaptive use of language. No effects of sibling order on adaptive use of language were observed in the group with other diagnoses (p=.278).
Conclusions: The current study failed to replicate the finding that the availability of older siblings is associated with improved social communication in ASD. In contrast, preliminary results suggested that individuals with ASD may benefit from interactions with younger siblings. This may reflect conventional order effects in that oldest siblings with ASD may benefit from a developmental period with undivided parental attention. Results add to evidence indicating the benefits of siblings for the development of individuals with ASD (Shivers and Plavnick, 2015).

255 **144.255** The Effectiveness of a Group Brief Parent Training for Parents with the Developmental Disorders

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Background: Â Various types of Parent Training (PT) have been developed as a family support program to meet the needs of parents who have children with developmental disabilities. However, practical challenges have been studied, such as contents, amount and length of the program varies among types of disabilities and needs of parents. Brief parent training program was expected to be effective for various needs, can address these problems.
Objectives: Â The purpose of this study was to examine the effectiveness of a shortened version of Tottori University-PT program (S-TPT) by analyzing variability of parents' behavior and cognition, and child's behavior.
Methods: Â 80 parents of children with intellectual/developmental disabilities were participated. The children were 4.11 years old on average and were provided therapy 2 to 8 times a month. The participants were divided into PT group (N=40; 31 boys and 9 girls) and controlled group (N=40; 33 boys and 7 girls). The PT group attends S-TPT, which were 5 sessions in one time a week for 5 weeks. S-TPT was performed in groups of 8-10 mothers/fathers each. The sessions consisted following: Reinforcement, the token economy system, three-term contingency, effective instruction, and antecedent control. Beck Depression Inventory-Second Edition (BDI-Ⅱ) , Parenting Stress Index (PSI) Parenting Styles and Dimensions Questionnaire(PSDQ) and Eyberg Child Behavior Inventory(ECBI)Â were used. These measures were given at pre- and post-program, and at 2-month follow up.
Results: Â In PT group, there were improvements of all measurements. Effects on the PT group compared to the control group were tested with two-way factorial analysis of variance (ANOVA), using the pre- and posttest scores. There was a significant difference in the main effect and the interaction on PSI, PSDQ item "Rebuke", and "Difficulty of the Corresponding".
Conclusions: Â In comparison between controlled group and PT group, it suggested that shorter parent training give positive effect on stress of raising child and depression. And, both groups showed improvement over 2-month follow-up. We consider that the reasons might be that child of a parent who was in both groups was provided therapy. Further, as for the behavior variability of child, there was the improvement, but no significant difference between groups. We want to make clear that point in the future.

256 **144.256** The Experience of Stress in Caregivers of Children with ASD: An Examination of Stressors

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Background:
The caregivers of children with autism spectrum disorder (ASD) have typically reported high levels of stress in previous research. The impact of stress is typically negative for the individual and in turn can impact therapeutic activities directed toward the child. The specific sources of stressors have received less attention than establishing the presence of stress.
Objectives:
To examine the utility of two low cost (caregiver completed) instruments to examine possible stressors in a large sample of caregivers of children with ASD and a comparison group of caregivers of children with other developmental delays. The research validated measures were chosen to represent the types of instruments needed for large scale screening in the public service, rather than for a research, setting. That is, instruments were chosen that caregivers complete, are inexpensive, and require modest professional training to score and interpret.
Methods:
A large state wide sample of children receiving early intervention services through the New York State Part C Early Intervention Program was utilized. The Parenting Stress Index (PSI) and the Pervasive Developmental Disorder Behavior Inventory (PDDBI) were administered at the time of entry to services.
Results:
266 caregivers responded and the average child age of the sample was 2.3 years. High levels of caregiver stress for the ASD group were recorded as has been reported in previous research. Significantly higher stress levels for the ASD group vs the comparison group were found. A significant proportion in the ASD group scored in the clinically elevated range. However, elevated stress level for the comparison group was also recorded. The PDDBI autism severity scores were positively correlated with PSI scores for both the ASD and comparison group, indicating a possible common composite source of stressors. However, analysis of the specific subscales of the PSI and PDDBI associated with child specific characteristics indicated complex interactions with group, such that there were both shared (such as problem behaviors) and separate (such as communication deficits) stressors.
Conclusions:
Appropriate emphasis has been placed on the necessity of early diagnosis and intervention for children with ASD. Less formal attention has been directed at caregiver needs and supports during this process. The use of the PSI as a low cost screener of caregivers to identify individuals experiencing elevated levels of stress in both ASD and other developmental delay groups is recommended. Such screening should be routine to allow caregivers to access appropriate services should they wish. The use of the PDDBI as a low cost instrument allows for identifying possible sources of stressors that can then form the basis of an appropriate caregiver-child assessment and intervention strategy. The present research indicates that there are shared and separate child characteristics that may affect caregiver stress in an ASD and non ASD population that may permit appropriate individualization of services. Results also affirm that caregiver stress is problematic not simply for caregivers of children with ASD.

257 **144.257** The Impact of Personality Traits on Outcomes in Caregivers of Individuals with Autism Spectrum Disorder in the Transition Period

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Background:
Raising children with autism spectrum disorder (ASD) is a difficult challenge for primary caregivers. Previous studies have identified child (e.g., number of problem behaviors) and parent factors (e.g., social support) related to caregiving stress (Stuart & McGrew, 2009). However, few studies have examined the impact of the "big 5" personality traits (i.e., neuroticism, extraversion, conscientiousness, agreeableness, openness; Costa & McCrae, 1992) on caregiving stress and *how* they may affect caregiving stress, although this is an area of active research in understanding caregiving in other disorders (e.g., cancer caregiving).
Objectives:
The current study examined the potential impact of caregivers' personality traits on stress during the period when individuals with ASD transition out of high school. The study also examined potential mediators and moderators (e.g., coping skills, use of negative appraisals) to determine how personality traits affect caregiving stress. The Double ABCX model was used as a framework (McCubbin & Patterson, 1983), which views caregiving stress as the additive impact of several independent factors: stressors, internal resources, and external resources.
Methods:
A total of 117 participants, recruited via Amazon Mechanical Turk and other methods (e.g., parent support groups, autism listservs), were caregivers of individuals with ASD who either will graduate within two years or graduated from high school within the past two years. Caregivers completed questionnaires online measuring caregiver burden, stressors (i.e., ASD symptom severity, problem behaviors, pile-up demands), internal resources (i.e., personality traits, cognitive appraisals, and coping strategies), and external resources (i.e., social support).
Results:
Parents reported moderate levels of caregiving stress in the transition period (M = 2.06, SD = .75). Greater caregiving stress was associated with higher neuroticism (r = .52, p <.001), and lower levels of extraversion (r = -.31, p <.001), conscientiousness (r = -.32, p <.001), and agreeableness (r = -.22, p = .01). Parallel mediation analyses indicated that use of passive avoidance as a coping strategy was a significant mediator between caregiving stress and all four personality traits, neuroticism (Indirect effect = .02, SE = .01, 95% CI = .01, .03), extraversion (Indirect effect = -.02, SE = .01, 95% CI = -.04, -.01), conscientiousness (Indirect effect = -.03, SE = .01, 95% CI = -.05, -.01), and agreeableness (Indirect effect = -.03, SE = .01, 95% CI = -.04, -.01). Social support mediated the link between agreeableness and caregiver burden (Indirect effect = -.01, SE = .01, 95% CI = -.03, -.001).
Conclusions:
The results demonstrate the potential importance of personality traits in explaining differences in caregiving stress in families of those with ASD. Specifically, parents high in neuroticism reported greater stress, whereas those high in conscientiousness, extraversion, and agreeableness reported lower stress. Results further indicated that the association between personality and burden was mediated by caregivers' use of maladaptive coping strategies, i.e., passive avoidance coping. The findings have potential applicability for interventions to reduce caregiver burden.

258 **144.258** The Impact of the Environment on Primary Care for Individuals with Autism

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Background: Primary care provides health promotion, disease prevention, health maintenance, counseling, patient education, diagnosis and treatment of acute and chronic illnesses in a variety of health care settings. Providers of primary care play a large role in the health-related care of individuals with autism spectrum disorder (iASD). Although iASD are reported to engage in a greater number of health care encounters compared to their neurotypical peers, these encounters are often fraught with difficulties that impact the provision of effective healthcare. Strategies to support the provision of primary care for iASD often focus on person factors, with less consideration of environmental impact. As recognized by the International Classification of Functioning, Disability, and Health (ICF), the environment has the potential to facilitate or constrain function of individuals. As defined by the ICF, environmental factors include the physical, social, attitudinal, and political/system environments in which people live and conduct their lives.
Objectives: The purpose of this study was to describe the environmental barriers and facilitators impacting primary medical care for iASD across the lifespan.
Methods: A scoping review was conducted using systematic methodology. Eleven databases were searched using the keywords "primary/health/medical care," and "autism." Inclusion criteria included: (1) studies exploring primary medical care experiences/challenges, (2) participants were iASD, caregivers, or primary care providers, (3) published in a peer-reviewed journal, (4) written in English in the last 10 years. Reported factors were characterized into the following ICF environmental categories: (a) products and technology, (b) natural and human-made environment, (c) support, (d) attitudes, and (e) services, systems and policies.
Results: The search yielded 11 articles meeting all inclusion criteria; 4 focused on adults while 7 examined pediatric populations. Studies were surveys (n=5), qualitative interviews/focus groups (n=4), and interventions (n=2).
Articles indicate that challenges exist for iASD in regard to primary medical care in all five ICF environmental categories. For example, communication difficulties arose frequently during visits, but success with pictorial, graphic, and assistive and augmentative communication *products and technology* were reported. The design of the waiting and medical rooms were also named as challenges; however, individualized modifications to the built and sensory *environments* were reported to contribute to successful encounters. A lack of *support* was described with family support services and disability services reported to be difficult to obtain, but when accessed led to positive experiences. Provider acceptance of ASD stereotypes and a lack of respect for parents were common barriers to care; care was facilitated when providers treated parents as experts and partnered with them in decision-making (*attitudes*). *Health systems and policy*challenges were diverse, but included a necessity for longer duration visits, timely care, and negation of financial disincentives.
Conclusions: Individuals with ASD experience great challenges in the access to and provision of primary care. This information has the potential to improve patient-centered care for this population by helping professionals identify priorities for efforts to address the primary care-related needs of this population. Strategies to best serve iASD should aim to adapt all five aspects of the environment as delineated in the ICF.

259 **144.259** The Influence of Social Support on the Stress of Families of Children with Autism Spectrum Disorder

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Background: Families raising a child with ASD experience higher levels of stress compared to those with typically developing children or those whose children have other developmental disabilities (e.g., Hastings et al., 2005; Cuzzocrea et al., 2016). Social support is a protective factor against stress (Bailey, Wolfe, & Wolfe, 1994), and may lower stress in families of children with ASD (Pottie & Ingram, 2008). However, social support among parents of children with ASD is lower than among parents of typically developing children or of children with other disabilities (Glazzard & Overall, 2012; Weiss, 2002), and little is known about factors that may increase or decrease social support for families of children with ASD.
Objectives: To investigate types of social support and family factors that may predict lower parental stress among families of children with ASD.
Methods: Data from families of children with ASD (*N*=45) were collected from a subsample of families from the Simons Simplex Collection. Social support was measured via the Social Support Index (SSI; McCubbin et al., 1991) and further queried in questionnaire format. Parental stress was measured via the Parenting Stress Index – Short Form (PSI-SF; Abidin, 1995) or the Stress Index for Parents of Adolescents (SIPA; Sheras, Abidin, & Konold, 1998). Linear regression analyses were conducted to explore social support prediction of parental stress, and forthcoming analyses will allow further exploration of contributors to parental stress and differences among families depending on specific types of support.
Results: In this sample, all participants were mothers of children with ASD. Child age ranged from 6 to 17 years (*M*=11.17, *SD*=3.27). Family income ranged from $18,000 to $490,000 (*M*=$130,970, *SD*=94,198.19). Social support scores ranged from 42 to 78 (*M*=61.13, SD=6.75). Results of linear regression analysis indicated that overall social support significantly predicted parental stress, $F(1, 31) = 7.22$, $p<.05$, $R^2=.189$.
Conclusions: Current findings were consistent with previous research in that families' social support predicted parental stress. However, this sample of parents of children with ASD experienced *higher* levels of social support than samples of other families with typically developing children (McCubbin, Patterson, & Glynn, 1996), which is contrary to previous research (e.g., Weiss, 2002). One potential contributor to this surprising finding may be the higher-than-average mean socioeconomic status of this sample, which may increase access to community resources and supports. Notably, despite the sample's overall high level of social support, there was considerable variability in the levels of social support endorsed. Since higher social support predicts lower parental distress within a sample that is well-connected to community resources and supports, attending to families' connectedness may be key in improving overall family functioning. However, relationships between these factors may vary depending on characteristics of the family (i.e., culture, socioeconomic status, etc.), and this is an important area of future research.

260 **144.260** The Parent Motivation for Early Intervention Participation Scale for Children with Autism Spectrum Disorder

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Background:
Family-based practices in early intervention (EI) facilitate the development of parental skills and provide families access to the resources necessary to support positive development of their young children with Autism Spectrum Disorders (ASD; American Psychological Association, 2013). Families are trained to use individualized strategies and acquire techniques in order to implement interventions with their children in the natural home setting (Hanson & Lynch, 2013). As family-implemented practices continue to be applied with parents of children with ASD, it is vital to evaluate how parental motivation to fully participate in implementation may affect the efficacy of these practices.
Objectives:
This poster will present findings from a pilot study on the development and implementation of the Parent's Motivation for Early Intervention Participation scale. The measure aims to assess parent's readiness to actively participate in interventions for their children with ASD.
Methods:
Using the Evidence-centered design framework, the researchers constructed forty-four items to represent a spectrum of motivation from readiness to resistant (Mislevy, Almond, & Lukas, 2003; See Figures 1-3). Readiness describes always being in a state of change and influenced by others, whereas ambivalent portrays clients who want their children's behaviors to change but realize this change may result in inconveniences in their lives. Resistance describes levels of denial and the act of defending the behaviors that are already in place (Rollick & Miller, 1993). Content validity was measured using seven experts who rated the items as "hard to agree with," "somewhat difficult to agree with," or "easy to agree with." Results were used to revise the items and finalize the rating scale, which was redistributed to a larger pool (n = 25) of experts in early childhood to further define theÂ targeted constructs. The final step in development includes distributing the scale to parents with children with ASD (n = 150) who are currently receiving EI services at home and conducting a factor analysis of the items.
Â Results:
The means of the items were calculated and ranked from highest to lowest. No item was rated as difficult to agree with by all seven experts. Experts were asked to rate how well the overall construct was being measured and the results ranged from 2 (adequately) to 4 (very much), with a mean rating on 3.14. Cronbach's alpha was .85 respectively, indicating high internal consistency. The average intra-class coefficient was .874 with a 95% confidence interval from .772 to .941. Results indicate that motivation may also be influenced by external barriers to participation (e.g., job responsibilities, finances) and the scale was revised to reflect these findings. Items applicable specifically to parents of children with ASD were also added to the finalized version of the rating scale.
Â Conclusions:
The construction of the parental motivation rating scale has helped further define reasons why families with children with ASD may or may not want to be actively involved in their children's intervention.Â Data from the final pilot study will be presented and discussed to further understand parents' readiness to actively participate in family-centered practices.

261 **144.261** The Quality, Not Quantity, of Play for Fathers of Children with Autism

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Background: Fathers continue to be involved with their children with Autism Spectrum Disorders (ASD), including engaging in physical play with them. Previous research suggests that fathers' quantity of physical play is associated with lower parenting stress. However, the quality and positive experiences during play have not been directly studied. The broaden-and-build theory suggests that the quality of play, including experiences of joy, can benefit individuals' well-being. This may be especially important for fathers of children with Autism, who report higher parenting stress, greater impact on parenting, and lower life satisfaction than fathers of typically developing children.
Objectives: Â The present study investigated the quality of fathers' physical play with their children with ASD and the outcomes of this for fathers, including: parenting stress, impact on parenting, and life satisfaction. Fathers' qualitative responses to questions regarding the quality of fathers' play were also examined. In addition, the established association between quantity of physical play and parenting stress was re-examined after accounting for the quality of fathers' play.
Methods: An online survey was completed by 60 fathers of sons with ASD aged 4 to 11 years. The survey included an ASD child screening measure, and questions regarding fathers' satisfaction with play, father-son relationship quality, frequency of play, and fathers' well-being (i.e. parenting stress, impact on parenting, and life satisfaction). Participants (M_{age} = 39.9) were primarily biological fathers, married, Caucasian, from Canada, and living in the same home as their sons with ASD (M_{age} = 6.9). An optional phone interview was conducted with a sub-sample of 20 fathers during which they answered two questions related to the quality of their play.
Results: Multiple regression analyses revealed that greater satisfaction with play and greater relationship quality both significantly predicted lower parenting stress, lower impact on parenting, and greater life satisfaction. Moreover, though frequency of play significantly predicted lower parenting stress for fathers, this was no longer significant after accounting for the quality of fathers' play. Responses to open-ended questions regarding the quality of fathers' play were analyzed qualitatively and four overarching themes were identified. Fathers reported that play is Positive and Fun, Negative and Challenging, Important to the Relationship, and part of a Father's Role.
Conclusions: Results suggested that the quality of play can have benefits for fathers of children with ASD, including aspects of parenting stress, impact on parenting, and life satisfaction. Moreover, results suggested that fathers' quality of play may be even more important to fathers' well-being than the quantity of play. These findings are consistent with the literature for fathers of typically developing children. Fathers' qualitative responses similarly highlighted their positive and negative experiences in play, and the importance of engaging in quality play for their father-son relationship and their role as a father. For instance, one father said, "my son and I have a very close relationship… we always try to find time for play and quality time together". Implications for conceptualizing father-child play and understanding the importance of engaging in quality play will be discussed.

262 **144.262** The Role of Parent Satisfaction with Parenting Efficacy in Links Between Depressive Symptoms and Observed Parenting in Families of Children with ASD

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Background: Parents of children with autism spectrum disorder (ASD) are at risk for high levels of stress and mental health problems, including depression (see Ekas, Pruitt, & McKay, 2016, for a review). These factors tend to challenge parenting quality in the general population (Hoffman, Crnic, & Baker, 2006). Despite this risk, observational studies tend to find few to no differences in parenting quality based upon child ASD status (e.g., Baker et al., 2010; Siller & Sigman, 2002; Van Izjendoorn et al., 2007), suggesting potential compartmentalization whereby parents of children with ASD are able to shield their parenting from such deleterious effects.
Objectives: The present study examined an affective component more proximal to parenting, parents' satisfaction with their sense of parenting efficacy, to see if it could inform links between parent depression and the quality of parent-child interaction in families of children with ASD.
Methods: Participants included 31 ethnically and socioeconomically diverse primary caregivers (2 fathers) of children with ASD between the ages of 4 and 11 years (M = 6.35, SD = 1.96). Parents were asked to complete the Center for Epidemiological Studies-Depression scale (CESD-R; Eaton et al., 2004) and the Parenting Sense of Competence questionnaire (PSOC; Johnston & Mash, 1989), which includes a subscale focusing on parents' feelings of satisfaction with their ability to parent. Parental scaffolding behaviors were rated during a 5-minute parent-child problem solving activity using the Parental Scaffolding Rating System (Hoffman et al., 2006; Baker et al., 2007), which measures parents' ability to motivate, emotionally-support, and instrumentally guide their children through a frustrating task. These and similar parenting behaviors have been found to be powerful predictors of important outcomes in children with ASD and early developmental delays (e.g., Baker et al., 2007; Baker et al., 2010; Fenning & Baker, 2012).
Results: No demographic variable considered (e.g., ethnicity, child age, child gender, education, income) was related to the variables of interest in a way that would confound the findings (i.e., to two or more variables). Consistent with the potential compartmentalization suggested by the literature, the association between depression and scaffolding was in the expected direction but was relatively low and fell short of significance, r = -.18, *ns*. Parents' satisfaction with their parenting competence, however, was moderately related to both parent depressive symptoms, r = -.46, p < .05, and observed scaffolding, r = .39, p < .05.
Conclusions: Consistent with the compartmentalization hypothesis, parents of children with ASD demonstrated only weak and non-significant associations between ratings of their depressive symptoms and their observed parent-child interaction quality. Depression was, however, moderately related to less positive feelings about their parenting efficacy which, in turn, moderately predicted less optimal observed scaffolding. This cross-sectional study cannot determine causal direction, and transactions among the factors are likely; however, findings do suggest the importance of considering affective factors more proximal to the parenting experience when attempting to understand relations between parent mental health and parenting behavior in families of children with ASD.

263 **144.263** The Role of Parents in a Social Communication Intervention for Children Who Are Minimally Verbal

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Background: Â The success of an intervention hinges on its capacity for sustainability and generalizability. Consequently, parent training has become a crucial element of many early intervention programs, as parents' uptake of treatment strategies is ideal for implementation across contexts. Parents' level of buy-in (i.e., expectations about treatment) can affect strategy uptake, ultimately affecting treatment outcomes in children (Nock & Kazdin, 2001). This process may elucidate why some children acquire spoken language during the course of intervention while others do not.
Objectives: Â To examine: 1) the relationship between parent buy-in and parent uptake of intervention strategies, and 2) how changes in parent behavior are consequently related to changes in child language outcomes.
Methods: Â Preschoolers (n=23) who were low-rate communicators (approx. <30 words) received JASPER, a naturalistic developmental social communication intervention (Kasari et al., 2006, 2008), for 6 months. Parents received weekly 2-month individualized training in JASPER strategies, including matching child's language (# words, # utterances) and JA gesture use.
Parents completed a questionnaire that assessed the broad range of pre-treatment buy-in. Each parent-child dyad completed a videotaped 10-minute free play assessment (PCX) pre- and post-intervention.
Children's minimally verbal designation at both entry and exit was determined if they used <5 words on the ADOS, <5 words on the PCX, and <8 words on the MSEL. This formed three groups of children: 1) those who remained minimally verbal over the course of intervention (MV), 2) those who acquired language during the course of intervention, i.e., were speech-emergent (SE; met MV criteria at entry, but not at exit), and 3) those who were early communicators (EC; never met MV criteria).
PCX's were transcribed, coded, and analyzed for language and gesture use (pointing, showing, giving). Composites and change scores were calculated and analyzed using linear regression and ANOVA.
Results: Parents' level of buy-in, particularly their belief in child improvement, was associated with change in parents' total utterances during the PCX (b=-.64, p=.001, R^2=.41), but not with gesture use. Change in parent utterances was significantly related with MV status at the end of intervention (b=.58, p=0.023, R^2=.38).
There were significant differences in parent language change between the three groups of children (F(2,20)=7.12, p=.005, η^2=.42). Post-hoc tests indicated significant differences between MV and EC groups (p<.05, d=2.26) as well as between MV and SE groups (p<.10, d=1.41).
Conclusions: Â Results point to potential factors contributing to treatment effectiveness in a population that is not particularly well-researched. Parent buy-in is related to measurable change in parent behavior in the context of intervention. These changes are also related to measureable and significant gains in children's language outcomes, such that children who were potentially MV pre-intervention no longer met this criteria post-intervention.
Parents who bought into treatment decreased their utterance use, providing more opportunity for their children to verbally communicate. However, while this study highlights the relationship between parent buy-in, strategy uptake, and child outcomes, it does not propose a causal model. As such, future research should examine a cross-lagged model to determine directionality and causality of this relationship.

264 **144.264** This Is What Friendship Is to Me: A Grounded Theory

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Background: Developing and maintaining social relationships is one of the greatest struggles faced by individuals with ASD. Individuals with ASD experience lifelong difficulties with social communication abilities, as well as many other behaviours that interfere with relationship building (Bauminger et al., 2008). Importantly, developing and maintaining friendships becomes increasingly difficult and complex through adolescence. While adolescents with ASD struggle in making friends, they consistently report a desire for friendship (Bauminger et al., 2000) and they do make friends (Petrina et al., 2014). More so, despite friendships that are unconventional and lower in quality, individuals with ASD are often satisfied with their friendships (Calder et al., 2012). Our understanding of friendship satisfaction among individuals with ASD is perhaps one of the greatest gaps in this field, and is largely the result of a lack of theoretical foundation for understanding how friendships are formed and experienced in this population from their own perspective.
Objectives: The present study addresses the question of how adolescents with ASD develop and maintain meaningful and satisfying friendships. This study explores the processes that are involved in establishing friendships in this population. Furthermore, this study examines the factors that contribute to and interfere with friendship building.
Methods: This study is being conducted in the methodology of constructivist grounded theory. The primary method of data collection is through interviews with 13- to 16-year-old adolescents with ASD. Prior to data collection the ADOS is administered to confirm ASD diagnosis. Interview data is currently being collected, and will continue to the point of saturation. Coding is being completed using the method of constant comparison (Charmaz, 2006; Glaser & Strauss, 1967), which involves continuously comparing the coding of interviews with each other to ensure that the eventual theory emerges from the data rather than from ideas imposed on the data by the researcher.
Results: Data collection and analysis is currently underway, and is projected to be completed in March 2017. The results of this study will establish a substantive theory of how adolescents with ASD establish and experiences friendship. This research will challenge traditional views that equate friendship quality with friendship satisfaction. Results will provide a better understanding of what a satisfying friendship can be for this unique population, how such a friendship is established, and the barriers that interfere with this process.
Conclusions: This research strives to develop a systematic understanding of the processes critical to the development and maintenance of meaningful friendships in adolescents with ASD in order to more effectively support them in meeting their needs. The development of theory from the ground up will provide a framework for developing new measures that will allow for a more accurate characterization of friendship among individuals with ASD. Most importantly, theory regarding the development of friendship specific to adolescents with ASD will provide a foundation for understanding how to appropriately and effectively support the development of these social relationships in a way that is meaningful and relevant to them.

265 **144.265** Toddler Social-Communication and Parenting Stress Are Mediating Factors in the Psychosocial Well-Being of Parents with ASD-Related Concerns

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Background:
The parents of toddlers with ASD-related concerns encounter significant delays to accessing diagnostic and intervention services for their child. While parents have reported feeling stressed, isolated, and fatigued during this time period, the psychosocial well-being of parents with ASD-related concerns about their toddlers has not been well-characterized empirically. The current study examined psychosocial well-being, as well as potential contributing factors that may affect parents' interactions with their toddlers (i.e., toddler social-communicative functioning and parenting stress), in 3 parent groups: those with ASD-related concerns, developmental delay (DD) concerns, and no developmental concerns.
Objectives:
To examine the extent to which the effect of parent group on psychosocial well-being is mediated sequentially by toddler social-communication and parenting stress.
Methods:
Parents completed surveys on the outcomes of interest at Time 1 as part of a longitudinal community-based research study; data collection is ongoing. The ASD-related concerns group *(n*= 22,males=16,$M_{age=}$ 26.41 mos) comprised toddlers whose parents indicated that they and/or a healthcare provider had concerns about ASD and/or social interactions.Â The DD concerns group *(n*= *15*,males=6,$M_{age=}$ 20.47 mos) comprised toddlers whose parents indicated that they and/or a healthcare provider had concerns about language and/or motor development. The no concerns group *(n*= *56*,males=21,$M_{age=}$ 19.95 mos) comprised toddlers whose parents indicated that they had no concerns about development.
Toddlers' social-communication was assessed as a mean score of the four domains on the Parent Interview for Autism-Clinical Version: Social Relating, Imitation, Nonverbal Communication, and Language Understanding. Parenting stress was assessed as a total score of the three subscales from the Parenting Stress Index: Difficult Child, Parental Distress, and Parent-Child Dysfunction. Parent psychosocial well-being was assessed as a mean score of the Psychological and Social Relationship scales on the WHO Quality of Life Survey.
Results:
A three-path, serial mediation analysis was conducted using PROCESS Model 6 (Hayes, 2013;**see Figure 1**). Parent group was analyzed as two dummy vectors and child age, sex, and parental education were included as covariates.
Parent group had a significant total effect on psychosocial well-being (path c); the ASD-related concerns group had lower levels than the other two groups. Parent group also had a significant effect on each of the two proposed mediators (path a_1 and a_2); the ASD-related concerns group had lower levels of toddler social-communication and higher levels of parenting stress than the other two groups. While the direct effect was not significant (path c'), indirect effect #3 was significant, indicating that the effect of parent group on psychosocial well-being is mediated sequentially by toddler social-communication and parenting stress.
Conclusions:
Toddler social-communication and parenting stress represent mechanisms that help explain why parents of toddlers with ASD-related concerns exhibit lower levels of psychosocial well-being than other parent groups. Lower levels of toddler social-communication and higher levels of parenting stress functioned sequentially to predict lower levels of psychosocial well-being. These findings suggest that providing the parents of toddlers with ASD-related concerns with strategies for improving their toddlers' social communication and their parent-child relationship may also have a positive and protective impact on their own well-being.

266 **144.266** Transition to Adulthood for Young People on the Autism Spectrum

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Background:
Transitioning to adulthood can be an exciting albeit challenging time for all, but particularly for those on the Autism spectrum. While many young people with Autism have average to above average intellectual capacities they are underrepresented in employment, further education and independent living, commonly experiencing poor outcomes common across the lifespan. The paucity of services for young people on the Autism spectrum and their families contributes to high levels of unmet need, with many struggling to navigate the transition process.
Objectives:
This study aimed to explore the views of parents of young people on the Autism spectrum on the enablers of transition to adulthood for this group.
Methods:
Four structured focus groups with 19 parents (14 mothers, 4 fathers and 1 step-father) regarding 23 young adults revealed 132 condensed meaning units. All but two parents held tertiary qualifications and 14 parents were in paid employment. Five of the parents were not in employment, citing their child's diagnosis as the reason for their lack of workforce participation. In-vivo analysis identified the themes of *to be understood*, *to understand the world* and *to succeed*. Secondary analysis linked condensed meaning units to the International Classification of Functioning, Disability and Health (ICF).
Results:
The theme *to be understood* recognized the social marginalization of young people on the Autism spectrum due to their core symptoms. *To understand the world* pointed to the parents' recognition that young adults on the Autism spectrum often experienced difficulties with social communication. These young adults needed opportunities *to succeed* in adult life, to demonstrate their strengths and build their self-efficacy. Secondary analysis revealed the theme *to be understood* mapped chiefly against the ICF domain of the e*nvironment* (63%), and constructs within *activity and participation domain* (37%). The theme *to understand the world* mapped predominantly to the domain of the activity and participation domain (62%) with links to the domain of *environment* (38%). *To succeed* linked to the ICF domain of the e*nvironment* (50%) and to constructs within the domains of *activity and participation* (42%) and *personal factors* (8%).
Conclusions:
This study highlighted parents belief that young people on the Autism spectrum are marginalised in part as a result of the social deficits associated with their diagnosis. Strengths-based individualised approaches, maximising the person-environment fit of these young people, are likely to facilitate successful outcomes in adulthood. Peer mentoring is one such approach, potentially reducing the need for parent's to advocate on behalf of their young person on the Autism spectrum, positively impacting on this relationship. This study demonstrates the utility of the ICF in research in providing a framework facilitating data analysis, which in this study pointed to the environment as an important intervention target in supporting young people with Autism in their transition to adulthood.

267 **144.267** Understanding Concerns Relating to Uncertainty about the Future in Adults on the Autism Spectrum and Their Families.

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Background: Little is known about the everyday lives of adults on the autism spectrum. Small scale projects indicate that anxiety related to uncertainty is a significant problem for many individuals on the autism spectrum and their families, though no systematic large-scale research has explored the specific nature and impact of these concerns.
Objectives: The aim of this project was to consult with adults on the autism spectrum and their carers/relatives about concerns regarding uncertainty about the future.
Methods:

- Four focus groups were conducted with adults on the autism spectrum (n=23), exploring concerns and hopes for the future. Participants also discussed strategies that were helpful and unhelpful in managing these concerns.
- An online survey investigating concerns relatives/carers had regarding the future for the adults with autism they were supporting, was completed by 120 family members. Seven main topics were explored; *residence*, *day-to-day living*, *future happiness*, *finances*, *relationships with others*, *support* and *vulnerability from others*. Respondents also completed questionnaires relating to their own wellbeing; Depression, Anxiety and Stress Scale (DASS-21) and Penn State Worry Questionnaire (PSWQ), as well as a Quality of Life Scale relating to the autistic adults they were supporting.

Results:

- Focus groups: Thematic analysis revealed an overarching theme relating to pervasive feelings of '*uncertainty'*. Subordinate themes included *uncertainty related to the impact of autism diagnosis,* regarding specific barriers and understanding from others and *uncertainty related to provision of support*.
- Online survey: 64% of respondents stated their autistic relative was "not at all prepared" for the future and 70% worried about this *at least weekly*. The most endorsed concerns were "whether they will be happy" (72% worried weekly) and "who will look after/care for them" (58% worried weekly). Relatives self-reported moderate levels of worry and anxiety, mild levels of depression and stress and high levels of intolerance of uncertainty. Respondents indicated that 83% of the adults with autism they were supporting experienced anxiety, 47% experienced depression. Respondents who stated their autistic relative was "not at all prepared" for the future had significantly higher levels of worry, anxiety, stress and lower quality of life than those who reported some degree of preparation.

Conclusions: This is the first study to explore concerns regarding the future directly with autistic adults and their families. The results indicate that uncertainty about the future is a significant issue in the lives of autistic adults and those supporting them. Both groups of participants viewed the future as very uncertain, reported feeling unprepared and unsure about how to prepare for the future. Furthermore, high anxiety, worry and stress and lower quality of life in relatives of autistic adults were associated with lack of preparation for the future. Adults on the spectrum and family members identified that support in preparing for the future was inadequate or insufficient for their needs. Further research exploring the impact that uncertainty about the future has on the mental health and wellbeing of adults on the autistic spectrum and those supporting them should be a priority for the future.

268 **144.268** Understanding Stress in Mothers of Children with ASD

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Background: Parents of children with autism spectrum disorder (ASD) are often faced with numerous potential challenges and daily stressors associated with parenting a child with special needs. These can be categorized as either parent- or child-specific. Parent-specific stress may be derived from the lack of social supports, the absence of effective coping strategies, and lower psychological well-being or depression in one or both parents. Child-specific stress is most commonly associated with the symptomology of ASD including communication impairments, decreased cognitive abilities, and impairments in social interactions.
Objectives: The objective of this study was to examine both the frequency and the level of stress in mothers of children with ASD who were initiating clinical services at our center, and to ascertain whether this was correlated with selected demographic data.
Methods: In this study, we examined maternal stress in the mothers' of 32 children with ASD (ages 2 to 11 years of age). Demographic data was compiled for each family, and mothers completed the Parental Stress Index-Long Form. ASD diagnoses in the children were confirmed by implementation of the ADOS and ADI-R assessments by a research-trained psychologist. Pairwise correlation analyses were conducted between maternal stress and selected demographic variables.
Results: Clinically relevant (>85th percentile) *Total Stress* PSI scores were reported in 72% (23/32) of mothers but this was not related to a number of demographic variables including maternal age, job status and education, marital status and family income.Â When broken down by *Child* and *Parent Domain* scores,Â 87.5% (28/32) and 18.75% (6/32) mothers had scores >85th percentile, respectively. Furthermore, out of mothers with clinically relevant *Total Stress Scores*, 30% (7/23) had *Total Stress* Scores of ≥99th percentile. A significant Defensive Responding raw score was reported for almost 10% (3/32) mothers, indicting that these respondents may have attempted to minimize their stress or the issues between themselves and their child in order to try to create a more favorable impression.
Conclusions: High maternal stress appeared to be driven by *Child Domain* scores, suggesting that many of the children in this study displayed qualities that make it more challenging for their mothers to fulfill their parenting roles, leading to dysfunctional mother-child interactions. What was more concerning, however, was the very high level of stress reported by some mothers. This has implications regarding the mother's immediate mental health status and that of the mother-child relationship. While developing and implementing a wide-range of supports for parents raising a child with ASD may be critical for family stability, more immediate interventions may be required for some parents to ensure the short-term health of their family unit.

269 **144.269** Using Mindfulness Based Stress Reduction to Reduce Caregiver Distress As Part of Behavioral Intervention for Young Children with ASD

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Background: Caregivers of children with ASD report elevated levels of distress (Carter et al., 2009; Davis et al., 2008) that can negatively impact parental health as well as the potential effectiveness of early interventions (Gallagher et al., 2009; Osborne et al., 2008). Therefore, it may be critical for early intervention services to ameliorate clinically significant caregiver distress as part of early intervention itself.
Objectives: This preliminary data is drawn from the initial phase a longitudinal randomized control trial comparing the effectiveness of an empirically supported parent-coaching intervention program, the Parent-implemented Early Start Denver Model (P-ESDM; n = 14), to a P-ESDM intervention enhanced with Mindfulness Based Stress Reduction for caregivers (MBSR; n = 10). Our objective was to evaluate differences in caregiver mental health and parenting stress across groups.
Methods: Participants included the caregivers of young children (m_{age} = 1.57 years, sd = .39) recently diagnosed with autism spectrum disorder. Children's ADOS-2 scores indicated moderate-to-high levels of autism symptoms (m_{ADOS-2} = 21.67, sd = 4.44) and significant developmental delays on the Mullen Scales of Early Learning (m_{MSEL}= 53.43, sd = 5.70). Participating mothers (n = 20) and fathers (n = 4) were randomly assigned to receive 12 weekly sessions of P-ESDM with and without 6 concurrent sessions of MBSR. Data was gathered at treatment initiation and conclusion.
Results: Â At baseline, both groups reported statistically similar levels of depression (m_{PESDM} = 10.54, sd = 6.97; m_{MBSR} = 10.30, sd = 9.35), anxiety (m_{PESDM} = 7.92, sd = 6.61; m_{MBSR} = 9.50, sd = 6.64), and overall parenting stress (m_{PESDM} = 94.70, sd = 15.00; m_{MBSR} = 87.91, sd = 10.85) as measured by the Centers for Epidemiologic Studies – Depression scale, Beck Anxiety Inventory, and the Parenting Stress Inventory. Although within group changes were not significant, the entire sample of caregivers showed trends toward decreased depression symptoms (m_{T1CESD} = 10.44, sd = 7.89; m_{T2CESD} = 7.96, sd = 3.15; t = 2.061, p = .051). Group differences emerged in self-reported anxiety at post-treatment, with caregivers who received MBSR reporting significantly lower anxiety levels than caregivers who did not (m_{PESDM} = 8.46, sd = 8.03; m_{MBSR} = 2.10, sd = 1.96; t = 2.44, p < .05). Caregivers who received MBSR also reported significantly lower levels of parenting stress (m_{PESDM} = 87.91, sd = 10.85; m_{MBSR}= 73.63, sd = 16.12; t = 2.32, p < .05).
Conclusions: Promising preliminary evidence suggests that MBSR reduced anxiety and parenting stress across the course of treatment. This provides initial support for directly addressing caregiver distress as part of treatment for young children with ASD.

270 **144.270** Willingness of Mothers of Individuals with ASD to Engage in Mobile Health Research

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Background:
A new direction for healthcare research involves the collection of personal health information through mobile technology, such as apps and wearable devices (e.g. Fitbit). Information that is already collected from these mobile technologies can be utilized in a way that allows researchers to capture new and informative data that has not yet been studied.
Objectives:

- Engaging mothers of individuals with ASD in mobile health (mHealth) research.
- Comparing the willingness and attitudes of mothers of children and adolescents with ASD to participate in mHealth research.

Methods:
Maternal participants/caregivers in the Interactive Autism Network (IAN)—a community-powered research network that focuses on improving the lives of individuals with ASD and their families—were invited to complete an online questionnaire designed to determine caregiver willingness and attitudes toward engaging in mHealth research. Invited maternal caregivers had previously participated in a related IAN study. Mothers were divided into two groups based on the age of their child: Group A consisted of mothers of adolescents/young adults (ages 15-29) and Group B consisted of mothers of preschool/elementary-aged children (ages 3 -12). A few mothers fell into both categories and their responses were included in both groups. The overall response rate for the questionnaire was 52% (Group A=43.2%; Group B=59.5%), demonstrating successful re-engagement of IAN mothers, particularly among the younger group.
The questionnaire focused on maternal caregivers because of the correlation between maternal health and the health of their child with ASD. Individuals with ASD have been found to be less healthy overall than their counterparts in the general population; therefore, focusing on maternal health is an effective way to improve the health and well-being of individuals with ASD.
Analyses included crosstabs and t-tests for comparisons between the responses of the mothers of the children and teens/young adults with ASD.
Results:
622 mothers (Group A: n=231; Group B: n=391) completed the questionnaire. Regardless of age, mothers reported willingness to share mHealth data for research purposes.

- Mothers indicated willingness to share their health-data, especially if it allowed researchers to learn about the quality of healthcare, disease and prevention, and related issues (Group A=91.3%, Group B=94.6%; p=0.080).
- Mothers in each age group reported a preference for control over what and with whom their mHealth information was shared (Group A=96.5%, Group B=96.3%; p=0.882). Similarly, they wanted to know who accessed their data. <1% in each group reported that they did not care who accessed it (p=0.559).
- Younger mothers more willingly embraced newer technologies to share their health data, including sharing GPS location (Group A=57.4%, Group B=62.7%; p =0.019).

See Tables 1 and 2 for more details.
Conclusions:
Mothers of individuals with ASD were willing to share their mHealth data with researchers with the promise of anonymity and a level of control over their information. Younger mothers were more willing to use newer technologies to do so. With this knowledge in mind, it is possible to begin implementing mHealth studies that collect such information in a way that cultivates the highest potential for completion.

271 **144.271** 'You Are Labelled By Your Children's Disability' – a Community-Based, Participatory Study of Stigma Among Somali Parents of Children with Autism Living in the UK

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Background: Â Children of migrant parents living in western countries are more likely to have an autism diagnosis than the general population, particularly autism with intellectual disability. Somali migrant populations carry a particularly high burden. Social stigma is commonly experienced by parents of children with autism, and can be more challenging for some parents than their child's impairments. There has been no previous in-depth exploration of autism-related stigma within a Somali community.
Objectives: Â To explore the nature of stigma experienced by Somali parents of children with autism in the United Kingdom (UK), and to consider how they coped with or resisted such stigma.
Methods: Â We used a community-based participatory research approach, collaborating with a community organisation of Somali parents. In-depth interviews with simultaneous translation were conducted with 15 Somali parents of children with autism living in Bristol, UK, in 2015. Parents were sampled purposively to capture diversity in children's age, severity of autism and time since diagnosis. Directed thematic analysis used Link and Phelan's model of stigma.
Results: Â Of the 15 participants, 12 were mothers (mean age 36). The 17 children with autism they cared for were 4-13 years' old, and five were girls. Two main themes with sub-themes were identified: the nature of stigma (labelling and stereotyping; separation; emotional reactions, discrimination and power), and coping and resistance (the power of language; faith as a resource; learning, peer support and community relationships). Children with autism were labelled and stereotyped (e.g. as 'sick', 'naughty', 'different') and parents blamed for not controlling them, leading to social rejection and isolation. Some parents isolated themselves and withdrew emotionally to protect themselves and their children, while others felt they were avoided and excluded. Stigma was associated with a poor understanding of autism, a lack of vocabulary related to autism in the Somali community, and prejudice against mental illness and disability. The disruptive behaviour associated with autism and the invisibility of the condition were identified as particularly difficult for others to understand. There was evidence of enacted and felt stigma and examples of discrimination. To resist stigma, parents countered negative labelling by finding their own language to describe their child's condition, learnt about autism, and drew on their religion and peer support from other parents.
Conclusions: Â Somali parents of children with autism experienced considerable stigma, in the form of labelling and stereotyping, as well as more overt forms of discrimination, leading to social exclusion and isolation. Supporting Somali parents to deal with stigma requires raising awareness of autism within the community, facilitating peer support, building on parents' existing coping resources and ensuring appropriate professional services and interventions are available.

272 **144.272** "I Thought the Regional Center Was a Deportation Trap" Documenting the Life Experiences of Undocumented Mexican Mothers of Children with Autism

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Background: As we attempt to include more under-represented, low-resourced families in research studies, one group that is difficult to engage is undocumented families. We know little about whether these families are obtaining a timely diagnosis or services for their children with autism.
Objectives: Â This study attempts to examine how undocumented low-resourced Mexican mothers of children with autism navigate the special education process, the helpers and challenges they face in doing so.
Methods: In partnership with a community-based organization, six undocumented Mexican mothers of children with autism spectrum disorder (ASD) were recruited to participate in one interview using snowball sampling. Mothers were interviewed in a semi-structured format in settings ranging from a community center for immigrants, public library, and participant's home in a large city in Southern California. Various procedures were put in place to safeguard confidentiality. All participants were asked to provide a pseudonym due to their undocumented status. None of their personal information was collected. The interviews, transcription, coding, and final analysis were conducted in Spanish using Dedoose software. Two raters, a doctoral student and a research assistant used open-coding techniques applying conceptual labels looking for common themes across interviews. Inter-rater reliability was established using Pooled Cohen's kappa at .78.
Results: We examined three broad themes during the open-coding process (1) Immigration experience and cultural differences (2) Financial challenges and helpers (3) Autism diagnosis and services. In terms of immigration and cultural experiences results suggest that undocumented Mexican mothers experienced grim circumstances in their countries of origin *(e.g. "Here, we are poor, too, but at least we have a plate of food on our table"),* which forced them to immigrate to the United States. Three of the mothers experienced significant challenges en route to the United States (e.g. *"I crossed the border with my daughter in the trunk of a car with four other people- we were very scared").* The other 3 mothers stated that they originally entered the United States on a tourist visa but then overstayed. All of the children with ASD were U.S. citizens by birth. In terms of financial challenges and helpers, most of the mothers had very low household incomes (i.e. $10,000-15,000/year) ("e.g. *I used to get paid by the piece (of sewing) and worked 16-hour days, not even making minimum wage*"). Most mothers had difficulty accessing healthcare or financial benefits because of a lack of social security number despite having income tax regularly deducted from their paychecks. Finally, in terms of ASD diagnosis and services, most of the mothers received a late diagnosis of ASD for their children (e.g. over 6 years of age) delaying critical early intervention services (e.g. *"I had no idea what autism was")* and had difficulty navigating the special education process at the regional center and public schools (e.g. *"I thought the regional center was a deportation trap")*.
Conclusions: School staff and service providers need to be aware of the challenges of serving these families in order to avoid late diagnosis and services gaps for their children with ASD.

273 **144.273** "We Have to Fight More:" Experiences of Black and African American Families Raising Children with Autism

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Background: Previous research has described significant barriers to appropriate Autism Spectrum Disorder (ASD) screening, diagnostic and early intervention efforts in the African American community. African American children visit providers on average three times more than White children to receive an ASD diagnosis, with a longer period of time between initial provider contact and diagnosis. Furthermore, African American children with ASD are 2.6 times more likely than White children to receive an inappropriate diagnosis such as Conduct Disorder or Attention Deficit Hyperactivity Disorder on their first specialty care visit. Once African American children are diagnosed with ASD, studies have found these children and their families are underrepresented in early intervention and genetics research, and face additional barriers to care. Apart from these concerning statistics, the current literature focusing on African American children with ASD is limited.
Objectives: We explored caregiver stress, coping responses, and experiences accessing the continuum of ASD services, from screening and diagnosis through intervention, in a sample of urban Black and African American families raising children with ASD.
Methods: Â Our community-based research team recruited parents and other primary caregivers of Black and African American children ages 18 and under with ASD in an urban Mid-Atlantic city (N=18). Participants completed the Parenting Stress Index, Ways of Coping Questionnaire, and a semi-structured interview. Qualitative data were coded and analyzed using NVivo 10, using grounded theory methods. We analyzed the quantitative data using descriptive statistics in SPSS.
Results: Â Child-related caregiver stress was elevated in our sample (mean percentile = 85, SD = 18.2). Participants' most commonly-reported coping mechanisms were problem solving and emotion regulation. On average, caregivers described a nearly 30-month delay between their initial concern and ASD diagnosis, which was attributed in part during the qualitative interviews to poor provider-family communication. Many participants spoke in depth regarding the impact of race on their experiences raising a child with ASD, including low provider expectations of child's abilities, lack of adequate resources in local schools, perception of the need to "fight more" to receive services, incorrect provider assumptions regarding family structure, and stigma surrounding ASD within the Black and African American community. Caregivers' recommendations for improving service access for Black and African American children with ASD will be summarized.
Conclusions: Our exploratory study identified numerous obstacles Black and African American children with ASD and their families confront to access appropriate services and support. In addition to barriers often reported by families of children with ASD in general, our research uncovered additional challenges, such a neighborhood violence and racial discrimination, which exacerbated delays to care. Despite reports of high levels of parent stress, the caregivers in our sample used primarily adaptive coping mechanisms to address stress. Future research should identify culturally-responsive interventions to support families under stress and build on existing strengths.

274 **144.274** "You Have a Lot of Work on Your Hands": Unsupportive Social Interactions for Parents of Children with Autism

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Background: Parents raising children with Autism Spectrum Disorders (Autism) report high stress that greatly affects their daily lives. Family Quality of Life (FQOL) refers to the ways in which a family member with a disability affects parents and siblings. Positive social supports can help to buffer against the strain associated with raising children with Autism. However, negative reactions that parents of children with Autism may receive from others have been less studied. Unsupportive Social Interactions (USI) refer to actions that are perceived as unhelpful or unwanted in the face of a stressful event. Very little research on USIs has been done in the context of parenting children with Autism. This concept is important to understand because negative or unsupportive responses may be more salient than positive social supports to parents' well-being.
Objectives: The purpose of the present study is to examine how USIs affect parents of children with Autism. This study investigates the extent to which positive social support and USIs are associated with FQOL for parents of children with Autism.
Methods: A sample of 97 mothers and 82 fathers of children with Autism aged four to 11 years completed an online survey (data collection is ongoing). Participants were primarily biological parents, Caucasian, married, had a family income of over $75,000 per year, had completed post-secondary education, and had one child with Autism. The questionnaires pertained to demographic information, family quality of life, social support, unsupportive social interactions, and other variables as part of a larger study. A subset of participants (n =12 mothers and 11 fathers) gave qualitative responses during a phone interview.
Results: Preliminary results suggested that the adequacy and availability of social support from professionals, family, and friends were significantly positively correlated with FQOL in this sample. In addition, a significant negative correlation was found between USI and FQOL, where more experiences of USI were associated with lower FQOL. Themes related to parents' experiences with USIs are described based on parents' interview responses.
Conclusions: Although researchers and clinicians have focused on the relevance of positive social supports for parents of children with Autism, it is also important to consider the harmful effects of USIs. The findings of this study support the extant literature that social support is closely related to FQOL. A novel contribution is the finding that USIs negatively affect FQOL for parents of children with Autism. Parents' qualitative responses illustrated similar findings. For example, one participant in this study described how a stranger in the grocery store said "you have a lot of work on your hands." The concept of USIs has received little attention in Autism research and should be studied in more detail. In order to promote optimal FQOL for parents of children with Autism, clinicians should also attend to the negative experiences that parents may face and explore ways to reduce their impact. Practical implications of this research are described, including how fostering Autism awareness in the community may help reduce the frequency of USIs.

275 **144.275** "the Dots Just Don't Join up": Understanding the Support Needs of Families of Children on the Autism Spectrum

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Background: Parenting a child on the autism spectrum can be a hugely rewarding experience. It can also be stressful for a variety of reasons, with parents often reporting stress levels that exceed those among parents of typically developing children, or those with other developmental conditions. Despite this knowledge, remarkably little research has examined the types of support that these families perceive to be beneficial to their and their children's lives.
Objectives: Â This study, co-produced with school-based professionals, sought to establish the support needs of autism families, living in inner-city London, from their own perspectives.
Methods: Â In Study 1, a sample of ethnically- and socioeconomically-diverse parents of autistic children with additional intellectual disabilities and limited spoken communication (*n*=139) took part in a brief initial survey examining parental wellbeing, self-efficacy and the extent to which they felt supported. In Study 2, in-depth semi-structured interviews were conducted with a sub-group of these parents (*n*=17), some of whom reported feeling supported in Study 1 and some of whom did not.
Results: Â The results from Study 1 suggested that, overall, parents' reports of their own mental and emotional health was encouraging: the majority of parents rated their health as 'good', 'very good' or 'excellent'. There was a substantial minority (23%), who reported they did not have someone to turn to for day-to-day help and support. Parents participating in Study 2 reported a distinct lack of services and supports designed to address their and their child's specific needs (particularly with regards to children's sleep, dietary, language and self-care needs), which ultimately made them feel isolated and alienated. When support was available, it was often perceived to be extremely difficult or even impossible to access and failed to fit with the realities of their everyday lives. Parents pointed to a combination of formal and informal supports that they felt would best meet their needs, generally corroborating the findings from the Study 1 survey data. The interviews, however, went further to identify the exact nature of the services they desired – that is, services that were proactive and family-centred in their approach, ultimately making them feel more connected and cared for.
Conclusions: Supporting parents around the specific areas of expressive language, diet, sleep and self-care skills should be seen as priorities for service providers. Critically, providing this support should be done within the context of a relational, family-centered approach – one that takes the time to understand the specific needs of the whole family (including siblings), building a close working relationship with them, and ensuring that they are supported at times when the parents and families feel they need it most.

276 **144.276** Engaging Latino Families in ASD Treatment Research

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Background: Â Low-income and ethnic minority families continue to face critical disparities in access to diagnostic and treatment services for autism spectrum disorder (Begeer et al., 2009). Despite the growing cultural diversity of the United States, ethnic minority children and families continue to be substantially under-represented in ASD research (Norbury and Sparks, 2013), and particularly in treatment research (West et al., 2016). There are currently no published studies on adapting ASD treatment for children and families from Latino immigrant communities, with the exception of a parent advocacy intervention (Magaña et al., 2016).
Objectives: Â To present an approach for adapting ASD treatment for Latino immigrant families, based on Rogers' Diffusion of Innovation (DOI) framework and evaluate its efficacy in engaging these families in treatment research.
Methods: Â The DOI framework identifies *knowledge* and *persuasion* as the first two stages in adoption of innovation. We targeted these two stages through steps taken to build awareness (*knowledge*), minimize complexity of the intervention (*persuasion*), increase the intervention's cultural compatibility with families (*persuasion*), and address issues of relative advantage and observability (*persuasion*). Research staff worked collaboratively with a stakeholder advisory board to adapt treatment manuals and strategies. Participants included 174 children and their parents drawn from 3rd through 5th grade in Title I schools in the DC metropolitan area. All participants met research criteria for either ASD or ADHD, though many had no prior clinical diagnosis. Treatment acceptability was assessed via parent attendance at trainings and a feedback questionnaire.
Results: Â Group differences were assessed using one-way ANOVA, using the FDR procedure to control for multiple comparisons. Latino families had significantly lower income (F=11.30, p=.001) and years of parent education (F=11.72, p=.001), which have been shown to predict lower engagement in research and treatment. Despite these barriers, Latino families attended the same number of trainings on average as other families (F=2.42, *ns*). Moreover, Latino families reported higher satisfaction with the program (F=17.56, p<.0001) and greater comfort with the skills (F=18.20, p<.0001) than other ethnic groups. Latino families also reported finding the manual more helpful, although this did not survive corrections for multiple testing.
Conclusions:
The strategies utilized in this study and pragmatic adaptations made over the course of the trial highlight the need for a thoughtful and flexible approach to working with low-income and ethnic minority families in community-based clinical research. Using these strategies, our team enabled high levels of engagement from Latino families who faced significant barriers to participation, outpacing all other ethnic groups in the study. Researchers need to take additional steps to build community trust and relationships in order to successfully recruit and retain participants in their studies. Researchers must be willing and able to invest more time at the beginning of their studies to involve community stakeholders in the process, establish trust within communities, and make changes to usual procedures in order to meet the needs of underserved families.

277 **144.277** Using Community Partnerships to Address the Fit of an Evidence-Based, Parent Mediated Intervention for ASD in a Medicaid System

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Background: Â Within the autism spectrum disorder (ASD) field, service access barriers and rates of attrition in ASD services are particularly relevant for parent-mediated interventions and may suggest a lack of fit when these services are implemented in underserved community settings. One strategy to improve the fit of parent-mediated interventions in these settings is to engage stakeholders around improving the delivery of these services.
Objectives: In a prior study, Roger's Diffusion of Innovations theory was used to guide collaboration with parents from low SES backgrounds (i.e. below the federal poverty line) and providers working with these families in the Medicaid system around improving the delivery of an evidence-based, parent-mediated intervention, Project ImPACT. The goal of the present study was to determine the impact of these adaptations on parents' and providers' perception of program attributes specific to Roger's theory (i.e compatibility, complexity, and relative advantage), as well as their intent to use the program.
Methods: The target number of participants for this study is 100 parents of a child with ASD and 100 providers working with young children with ASD. Preliminary results are presented from 83 parents and 79 providers from a variety of socioeconomic backgrounds. Participants were randomized so that they either watched a 13-minute, video-based presentation of the original Project ImPACT program, or the same 13-minute, video-based presentation of the adapted Project ImPACT program. All presentations were standardized in format, length, and visual appeal. After watching the presentation, participants rated the following: 1) demographic information; 2) Project ImPACT attributes (i.e. compatibility, complexity, and relative advantage); 3) intent to use the program; and 4) either parent mental health or provider implementation climate.
Results: Two-way, between-subjects ANOVAs were run to examine the impact of program type (original vs. adapted), participant SES (i.e. above vs. below federal poverty line), and their interaction on perceptions of program attributes (i.e. compatibility, complexity, and relative advantage) and intent to use either program. Preliminary results are displayed in the supplemental table. Results show no main effect of program type or SES on parents' ratings of program attributes or intent to use. However, there was a significant interaction between SES and program type such that low SES parents rated the adapted program more favorably and reported greater intent to use than the original program. These findings were somewhat similar for providers, with providers working with low SES families rating the adapted program as less complex and reporting greater intent to use the adapted program, however, these results were only marginally significant.
Conclusions: Results from the present study suggest that community partnerships may be beneficial in increasing the perceived fit of parent-mediated interventions within low SES settings, although these benefits may be setting-specific. Importantly, Roger's Diffusion of Innovations theory may be a framework that can be used by researchers to guide adaptations aimed at improving the delivery of evidence-based, parent-mediated interventions without changing the core components of the intervention. Future directions include assessing the actual impact of these adaptations when implemented within the Medicaid system.

278 **144.278** Partnering to Adapt Evidence-Based Intervention for Delivery with Ethnic Minority Families

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Background: Although difficulties implementing evidence-based practices (EBPs) exist across cultural environments, disadvantaged groups experience particularly limited access to EBPs in their communities. For individuals who access care, research suggests that ethnic minority families are likely to receive lower quality care than ethnic majority families across multiple quality indicators (Magaña et al., 2013; Magaña, Parish, Rose, Timberlake, & Swaine, 2012). Parents of Hispanic children, for example, reported that providers were not sensitive to family values and were more likely to report that providers did not offer enough information or create an environment that promoted partnership with parents. This research speaks to the need to specifically improve the dissemination of culturally sensitive interventions to improve early intervention for underserved, minority populations. The BRIDGE Collaborative is an academic-community partnership that has adapted a parent-mediated naturalistic developmental behavioral intervention with specific focus on cultural appropriateness for Spanish-speaking families. A community trial of the adapted intervention is currently underway.
Objectives: The objective of this presentation is to share the process of adaptation and implementation of a naturalistic developmental behavioral intervention that was designed for maximum community fit and cultural sensitivity. Additionally, fidelity of implementation of the intervention when delivered in English versus Spanish is examined.
Methods: The BRIDGE Collaborative is an academic-community partnership with the goal of improving access to care for young children with risk for ASD. This group identified an EBP that met stakeholder needs based on input from community sources at multiple levels, including Spanish-speaking providers and families. A systematic, iterative process of adaptation was conducted in collaboration with community stakeholders. The adapted intervention is now being tested in a large urban county, including delivery in English and Spanish. Fifteen agencies participated in a train-the-trainer model of intervention training; agency leaders received training from researchers and returned to their agencies to provide training to therapists. Five of the participating agencies have bilingual leaders and/or therapists who deliver the intervention in both English and Spanish. Video observations of participants were collected both before and after training, and were coded for fidelity of implementation. Additional measures (e.g., satisfaction with services, implementation surveys) were collected from interventionists, as well as families who received intervention.
Results: Feedback from Latino/a providers and parents resulted in the reduction of text in the parent manual, the development of culturally appropriate examples, the creation of summary handouts for intervention strategies and translation of materials into Spanish. Fidelity data from bilingual interventionists indicates substantial differences in strategy use depending on language of delivery (English or Spanish), including decreased prompting of specific skills and less modeling of communication and play when delivered in Spanish.
Conclusions: Differences in how intervention is delivered to English versus Spanish speaking families can inform efforts to improve the quality and fit of treatment for underserved populations. These data support the need for attention to the cultural appropriateness of individual strategies within an intervention. Further, it suggests the need to adapt intervention materials to meet the specific cultural and communication needs of multiple ethnic minority populations.

279 **144.279** A Community-Partnered Intervention in South Los Angeles for Young Children at-Risk for ASD

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Background: As more effective interventions are developed for children with Autism Spectrum Disorders (ASD), there is an increasing demand for early detection and dissemination of empirically supported treatments, especially in under-resourced communities where African American and Latino families face disproportionate access barriers. There is a critical need to identify these children at younger ages and partner with community providers to promote positive outcomes.
Objectives: The goal of this study was to use Community Partnered Participatory Research (CPPR) practices to collaborate with childcare centers to increase access to ASD-related services in South Los Angeles by 1) identifying children at-risk for ASD, and 2) adapting and implementing an intervention teaching social communication and play.
Methods: Children between the ages of 16-60 months of age were recruited from the Children's Collective, Inc (TCCI), a childcare consortium serving children and families living in South Los Angeles.
Screening. Two parent questionnaires, the Parent's Evaluation of Developmental Status (PEDS) and the Modified Checklist for Autism in Toddlers were used to assess for early indicators of ASD. Children who screened positive were invited to participate in the classroom intervention.
Intervention. The experimental intervention is based on JASPER, an evidence based model for teaching social communication and play to young children with ASD. Childcare sites were randomized to either an immediate 4-week treatment or a waitlist. Intervention was comprised of teacher-mediated 30-minute sessions three days per week in the classroom. Children were assessed at the beginning and end of treatment.
Teacher-child play interactions were coded in one-minute intervals for engagement states, play level, affect, and teacher directiveness. In addition, the frequency of child joint attention gestures and language were continuously coded. This coding system has been reliably used in other classroom-based studies of preschoolers with ASD (Chang et al., 2016).
Results: 124 children across four child care centers participated in developmental screening. Of those 124, twenty children screened positive on either the PEDS or the MCHAT and were invited to participate in the intervention phase of the study. A mixed model analysis showed a significant treatment by time interaction such that children in the immediate treatment group showed greater improvement in play level across the intervention period compared to the waitlist control children ($F(1,31)=40.97$, $p<0.001$). There was also a trend showing that children in the treatment showed greater improvement in joint attention language compared to the waitlist ($F(1,15)=3.49$, $p=0.08$). Teachers in the treatment also showed less directive and more responsive interaction styles across the treatment period compared to the control ($F(1,18)=6.93$, $p<0.05$).
Conclusions: This study showed the effectiveness of JASPER when adapted and implemented in community with childcare providers and children who screened at elevated risk for ASD. Both universal screening and intervention were successfully employed using community-partnered practices, including shared decision making, and co-development of the intervention for the community setting. By partnering with the community in which the child resides to develop appropriate intervention models, one may begin to breakdown barriers to accessing early intervention.

280 **144.280** The Broad Autism Phenotype and Parenting Sense of Competence in Mothers of Children with Autism Spectrum Disorder

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Background:
Mothers of children with autism spectrum disorder (ASD) face unique challenges associated with parenting their child. These challenges may lead to increased parenting stress and depression in mothers (Davis & Carter, 2008). Mothers of children with ASD also report negative perceptions of their own parenting abilities compared to parents of typically developing children (Giallo et al., 2013). Mothers of a child with ASD may experience milder symptoms characteristic of ASD, which are referred to as the broad autism phenotype (BAP). Higher levels of BAP symptoms are associated with increased depressive symptoms (Ingersoll & Hambrick, 2011); however, Lau and colleagues (2016) found no associations between BAP and parenting sense of competence (PSOC).
Objectives: To examine the association between the BAP and PSOCe in mothers of children with ASD. This study also sought to examine whether aspects of maternal well-being mediate this association.
Methods: Eighty-two mothers of a child with ASD ($M_{childage}$ = 8.70 years) participated in this study. Mothers completed surveys online via Qualtrics. Surveys included the Broad Autism Phenotype Questionnaire, the Parenting Sense of Competence scale (subscales consist of parenting satisfaction and parenting efficacy), the Center for Epidemiological Studies-Depression scale, and a measure of benefit finding. All scales have been used with this population in previous research.
Results: Maternal BAP was negatively associated with PSOC (r = -.36, p = .001). The PROCESS macro in SPSS was used to examine the hypothesized mediation model depicted in Figure 1a. As shown in Figure 1b, the direct effect of the BAP on PSOC was not significant (b = -2.96, SE = 1.54, p = .06). Instead, the association between the BAP and PSOC was mediated by maternal depressive symptoms (indirect effect = -1.07, SE = .54; 95% CI: -2.49, -.26), such that increased BAP symptoms were associated with elevated depressive symptoms which, in turn, were associated with lower PSOC. Although benefit finding was associated with both BAP symptoms and PSOC, the indirect effect fell short of significance (indirect effect = -1.06, SE = .71; 95% CI: -2.74, .13). Follow-up analyses with the individual subscales of the PSOC found that depressive symptoms mediated the association between BAP and parenting satisfaction (indirect effect = -.86, SE = .40; 95% CI: -1.87, -.26); however, only benefit finding mediated the association between BAP and parenting efficacy (indirect effect = -.78, SE = .38; 95% CI: -1.74, -.18).
Conclusions: Â Mothers of children with ASD who report elevated BAP symptoms also report feeling less competent as a parent. This relationship was explained by maternal depressive symptoms and the ability to find benefits as a result of their child's diagnosis. The BAP consists of difficulties making and maintaining relationships and difficulty adapting to change. Therefore, it is possible that these difficulties exacerbate the already existing challenges of parenting a child with ASD. Given that mothers of children with ASD with elevated BAP symptoms have difficulty implementing parent-mediated interventions (Parr et al., 2015), the results of this study highlight an important area for clinical consideration.

281 **144.281** Parenting Practices, Temperament, and Depressive Symptoms in School-Aged Children with Autism Spectrum Disorder

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Background: Positive parenting practices are essential for successful child development, yet there are few studies of parenting children with autism spectrum disorder (ASD). The available evidence suggests that while there may be minimal differences in how parents of children with ASD and parents of children with typical development (TD) parent (Maljaars et al., 2014), harsh parenting practices used by parents of children with ASD relate to increased behavioral problems (Brenner & Fox, 1997). In TD youth, positive parenting practices can buffer a child at risk for developing depression because they moderate the association between temperaments characterized by negative emotionality and depression (Belsky & Pluess, 2009). Because children with ASD are at high risk for depression and negative affect (Simonoff et al., 2008; De Pauw et al., 2011), we tested whether parenting practices similarly interact with child temperament to buffer against child depressive symptoms in those with ASD.
Objectives: We aim to (1) describe how parents of children with ASD rate their parenting practices compared to parents of TD children, and (2) examine whether parenting practices moderate the association between child temperament and depressive symptoms.
Methods: The current sample includes 37 children—19 with ASD, and 18 with TD—matched on verbal IQ and age (8-12). Parents reported their own parenting practices using the Child Rearing Practices questionnaire (CRPQ; Neppl et al., 2003), their child's temperament using the Temperament in Middle Childhood Questionnaire (Simonds & Rothbart, 2005), and their child's depressive symptoms using the Child Behavior Checklist (Achenbach & Rescorla, 2001). Using a composite variable comprised of positive reinforcement, inductive reasoning, and confidence scales from the CPRQ, we used multiple regressions to test the interaction effect of positive parenting and negative affect on depressive symptoms in the whole group and only within the ASD group. All analyses were performed using SPSS 23.
Results: There were minimal group differences on parenting practices as assessed by the CRPQ (Table 1), although parents of children with ASD reported higher frequency of managing behavioral problems and lower confidence when managing them. There also were few group differences in the moderator analysis. Negative affect was positively associated (b =.58, p<.001), and positive parenting was negatively associated (b = -.28, p<.05) with depressive symptoms in the combined groups. The interaction between negative affect and parenting practices was significant (b =.46, p<.001)—indicating that for children with low negative affect, positive parenting practices were associated with lower depressive symptoms. For children with high negative affect, positive parenting practices did not show the same protective association (Figure 1).
Conclusions: Parenting practices and their protective effect on child depression appear to be similar across bothÂ the ASD and TD groups. Positive practices related to lower ratings of child depressive symptoms—yet children with low negative affect appeared to benefit more. Given that positive parenting may be most useful for children after issues related to underlying negative affect have been addressed, clinicians should ensure that parents have the skills to successfully manage these issues while promoting positive parenting.

282 **144.282** What Contributes to Parenting Stress and Challenges in the Parent-Adolescent Dyad?: Consideration of Both Parent and Adolescent Factors.

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Background: Parents of adolescents with ASD face unique challenges. Unsurprisingly, there is ample evidence suggesting that these parents experience increased stress and challenges in parent-adolescent dynamics, especially for those with more severe ASD symptoms. Moreover, many parents also have an increased proclivity to be affected by intra-individual challenges, including psychopathologies such as anxiety and depression. Such predispositions may exacerbate and be exacerbated by parenting struggles. However, research has yet to examine the relative impact of adolescent and parent factors on parenting stress and parent-adolescent relationships in families of adolescents with ASD, nor the potential malleability of parental depression through a social skills intervention for adolescents with ASD.
Objectives: This study examined the relative importance of parent depression, adolescent ASD symptomology, and adolescent physiological regulation on parenting stress and the parent-adolescent relationship, as well as the effect of the PEERS®social skills intervention on parent depression.
Methods: Sixty-four adolescents (Age: M=13.67, SD=1.5; IQ: M=99.64, SD=17.72) with ASD participated in this study. ASD was confirmed using the ADOS. Participants were randomly assigned to an experimental (n=32) or waitlist group (n=32) for participation in the PEERS®(Laugeson & Frankel, 2010) social skills intervention. All parents completed questionnaires assessing their own depressive symptoms (Beck Depression Inventory), parenting stress (Stress Index for Parents of Adolescents), parent-adolescent relationship quality (Parenting Relationship Questionnaire and Parent-Child Relationship Inventory), and their adolescent's social abilities (Social Responsiveness Scale) during the intake appointment. Parents also reported on their depressive symptoms 15 weeks after the initial intake (post intervention for the experimental group). Respiratory Sinus Arrhythmia (RSA) was measured using Porges and Bohrer's (1990) technique via the Cardioedit and Cardiobatch programs (Porges: Chicago, IL) at intake.
Results: Parent Depression and Adolescent ASD Symptoms were related to, and each explained unique variance in, multiple dimensions of parenting stress and parent-adolescent relationship dynamics in families of youth with ASD (Table 1 and 2). Of note, when considered together, Parent Depression but not Child ASD Symptoms explained unique variance in the parent-domain of the parenting stress measure (Table 2). Adolescent RSA was related to specific components of parenting stress and parent-adolescent relationship factors (Table 1) such that higher RSA (less dysregulation) was related to less stress in the parent-adolescent relationship domain and better communication. Importantly, Parent Depression decreased from pre- to post-intervention for the experimental group ($t(29)=2.07$, $p=0.05$), while no such decrease was evident in the waitlist group ($t(32)=-0.32$, $p=0.75$).
Conclusions: Parents suffering from depressive symptoms and those parenting an adolescent with more severe ASD symptomology or greater physiological dysregulation were likely to experience heightened parenting stress and greater struggles in the parent-adolescent relationship. An alternate interpretation of these findings may be that depressed parents were more likely to perceive the challenges of parenting as more stressful and the parent-adolescent relationship as less optimal. Furthermore, receiving a social skills intervention for their adolescent may ameliorate depressive symptoms in parents of adolescents with ASD. Regardless, this study demonstrates the importance of considering individual differences among parents of adolescents with ASD in future research.

283 **144.283** Correlates of Barriers to Service Access for Individuals with ASD Across the Lifespan: Findings from a Canadian National Survey

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Background: Across the lifespan, individuals with Autism Spectrum Disorder (ASD) have many health, community, and social service needs. Service needs are often left unmet and place a high level of burden on individuals and their families. Identifying the barriers of access to each service and the sociodemographic, clinical and systemic correlates of various barriers will improve the quality of life for individuals through targeted changes in policy.
Objectives: The objective of this study was to identify the barriers to service access for different services and the sociodemographic, systemic, and clinical correlates of barriers across the lifespan.
Methods: An online survey was administered across Canada through the Canadian Autism Spectrum Disorders Alliance, completed by 3251 caregivers reporting on 3317 family members with ASD. Analysis was done in an age-stratified manner. Current service use was operationalized as any service used in the last 6 months, from a list of 23 community and health services and an "other" category that was recoded as needed. From the same list, participants indicated which services were difficult to obtain and selected barriers to accessing services from a list of 10 and an "other" category.
Results: Â The number of systemic barriers endorsed was 3.4 (SD=1.9) and increased across age groups (4 years and under: 2.8, SD=1.6; 5-11 year olds: 3.2, SD=1.7; 12-17 year olds: 3.6, SD=2; 18-24 year olds: 3.6, SD=2; 25 and older: 3.5, SD=2; $F[3316,4]=14.12$, $p<.001$). Across the sample, the most common barrier to accessing services was being on a waitlist (75%), followed by a lack of trained professionals (48.5%) and affordability (31.6%). Older individuals were more likely to report not obtaining services because of a lack of trained professionals ($\chi^2=30.07$, $p<.001$; e.g. 52.7% of 25 years and older vs 35.6% of 4 and under) and that diagnosis did not qualify for needed services ($\chi^2=28.17$, $p<.001$; e.g. 42.4% of 25 years and older vs 12% of 4 and under). More than half of the respondents in both adult groups reported that a barrier to access was being too old for the needed service. Predictors of the total number of barriers included financial trouble, receiving caregiver services, and multiple clinical factors (i.e., more mental health concerns, behavioural concerns, worse health score; all p's <.001).
Conclusions: The results show the specific barriers to accessing services in a large sample of individuals with ASD. Future analyses will identify how sociodemographic, clinical need, and systemic factors predict barriers to different services in each age group. Discussion of the implications of these findings will follow.

284 **144.284** Family Quality of Life While Waiting for Government Funded Applied Behaviour Analysis Services for Children with ASD

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Background: Families of children with autism spectrum disorder (ASD) often experience high levels of stress related to demands on their time, the health and behavioural needs of their child with ASD, and the health of other members of the family. It is important to investigate their family quality of life (FQOL) in order to understand how best to serve the entire family, not just the child.
Objectives: The purpose of this study was to examine the FQOL of families with a child with ASD who were waiting for government funded Applied Behaviour Analysis Services in Ontario, Canada.
Methods: An adapted version of the FQOL Survey for main caregivers of people with intellectual or developmental disabilities (Brown et al., 2006) was sent out to families with a child or adolescent on the Durham Applied Behaviour Analysis (ABA)-Based services for Children and Youth with ASD waitlist. The adapted FQOL Survey consisted of six sections from the original instrument, including About Your Family, Health of the Family, Support from Disability Related Services, Leisure and Recreation, Community Interaction, and Overall Family Quality of Life. Parents were also asked a series of open-ended questions related to their community interactions, recreation and leisure, and overall FQOL. Of the 484 surveys sent out, 147 were returned (31% response rate); 123 (84%) of the returned surveys were for families with a child less than 12 years of age.
Results: The average age of the children in this sample was 7.3 years (19% female) and the average age at diagnosis was 5 years. Parents reported that they had been on the ABA waitlist for an average of 8.6 months. The most influential factors for FQOL were whether the child with ASD had a major health concern, whether the family's needs were met by disability-related services, and whether there were opportunities to engage in leisure and recreation activities. Parents reported that there were several disability-related services that their children were in need of, but that they were unable to access. Results also indicated that parents of children with ASD were living with a variety of chronic physical and mental health conditions (e.g. depression, Fibromyalgia). Parents expressed a desire to be able to take their child out in the community without a "meltdown," and particularly mentioned the social isolation they experienced.
Conclusions: Â These results indicate that parents feel that access to disability-related services for their child with ASD is very important for FQOL; however, many families are not accessing these essential services due to long wait-times, financial concerns, and their child being expelled from various programs due to behavior challenges. These results also demonstrate that family members of children with ASD may experience high levels of physical and/or mental health concerns, which negatively impacts overall FQOL. Future research and programming should target program accessibility and overall family health in order to better serve families of children with ASD.

285 **144.285** Family Quality of Life within the Context of a Participant-Directed ASD Funding Program

E. C. Gardiner[1] *and G. Iarocci*[2]*, (1)Pediatrics, University of British Columbia, West Vancouver, BC, CANADA, (2)Simon Fraser University, Burnaby, BC, CANADA*

Background: The province of British Columbia (BC) has adopted a participant-directed model of autism spectrum disorder (ASD) service delivery, in which families are able to allocate funds toward the services they deem appropriate.Â Although placing decision-making directly in the hands of families aligns with best practices of family-centred care, research indicates that families may struggle with the lack of structure, and perceive service coordination as burdensome and overwhelming. The way in which the service system is designed in terms of funding allocation, service accessibility, and availability of guidance likely plays a critical role in how well families feel they are supporting their child with a disability, as well as in overall family wellbeing.Â We are currently in the dark as to how BC families perceive funding and service access, and this research shed light on their experiences.
Objectives: Â The goal of this mixed-methods research was to ascertain families' perceptions of the provincial participant-directed funding program, as well as the perceived impact on family quality of life (FQOL).
Methods: Caregivers (*N*=118) of individuals with ASD (aged 6-18 years; *M*=11.7) completed an online survey, in which they rated their satisfaction with available support, and completed the FQOL Scale (Hoffman et al., 2006).Â One hundred and fifteen respondents also provided qualitative comments elaborating on their satisfaction ratings.Â Fifteen caregivers participated in follow-up interviews, in which they elaborated on their perceptions of service delivery, highlighting the associated strengths and challenges.Â Qualitative data was analyzed using a modified grounded theory approach (Weston et al., 2001).
Results: Overall, online survey results indicated that only 26% of participants were 'satisfied' or 'very satisfied' with the resources and funds available to their family.Â Participants' open-ended comments indicated that although they were grateful for the funding, they were frustrated by the many perceived limitations. These included long waitlists, lacking services for specific groups (e.g., adolescents), and a desire for supports geared toward parents and families (e.g., family counseling). Finally, caregivers communicated their wish that the funding system be more flexible.
Similar themes emerged within follow-up interviews. Although caregivers acknowledged their appreciation of the funding, they indicated that the provided amount was insufficient to access their desired level of support. Moreover, they described the funding system as inefficient, inflexible, and inconsistent. In particular, caregivers noted a prevailing lack of guidance, and highlighted their feelings of isolation in service navigation.
Conclusions: This research revealed important insights into the strengths and challenges associated with the BC participant-directed funding model, as perceived by service users. We suggest that it is not enough to simply make families responsible for service coordination if they are not also armed with the necessary knowledge and guidance to make informed decisions. Without such guidance, family-directed service is not viewed as empowering, as is suggested within the family-centred philosophy, but is instead perceived as overwhelming, burdensome, and time consuming. It appears that funding services for children with ASD is necessary, though not sufficient to address the complex needs of these families. We conclude with recommendations for practice and policy.

286 **144.286** Examining the Impact of an Hcbs Autism Waiver on Families of Children with Autism in Maryland: A Mixed-Design Study

K. Eskow[1] *and J. A. Summers*[2]*, (1)Towson University, Towson, MD, (2)University of Kansas, Lawrence, KS*

Background: Families of children with autism are under stress that exceeds that of families of typical children and even those of children with less challenging disabilities. States have begun to recognize the need for family support and many have tapped Medicaid funding through HCBS Waiver services. However, little is known about the impacts of these services. Maryland, which administers the largest autism Waiver program in the country, offers a unique opportunity to study family impacts due to the presence of both a large number of Waiver families as well as a registry of families waiting to access the Waiver. In conjunction with the Maryland State Department of Education (MSDE) research has been conducted since 2008 comparing families of individuals receiving waiver services to a control group of families who expressed interest in receiving services, but who were not yet determined eligible for services. The authors assessed families on a variety of quantitative measures including demographic questions, Family Quality of Life (FQoL), satisfaction with services, reported child progress, reported need for services, and employment information (Eskow et al., 2011; Eskow et al., 2015). Results indicated higher FQoL for individuals on the waiver compared to those on the registry (Eskow et al., 2011), as well as greater perceived *improvement* in child with autism's independent living skills (Eskow et al., 2015).
Objectives:

1. To examine the impact of Waiver services on family quality of life (FQOL), employment, and family perspectives of their children's progress, in comparison to families on the registry;
2. To explore family perspectives of the components of Waivers that contribute to family outcomes.

Methods: Â This was a mixed-design study. For the quantitative study, we used propensity matching to develop equivalent samples of 552 families, including 282 waiver recipients and 270 on the registry. We conducted a statewide mail survey of these families to measure their utilization of and satisfaction with services, their FQOL, impact of their child's autism on parents' employment, and perceptions of their child's academic, independent living, social, and communication progress. For the qualitative study, we purposively sampled families giving permission to be re-contacted to identify a diverse sample of 48 respondents. We analyzed the transcripts using Atlas+.
Results: We found that families on the Waiver scored significantly higher in their FQOL and in independent living skills for their children. Qualitative results suggested that in-home services and flexible partnership with the Waiver service coordinator were critical factors contributing to these results. Employment was more nuanced, with Waiver services enabling families to access a wider range of choices for employment.
Conclusions: Â Recent findings are consistent with prior research (2011, 2015) thus providing quantitative evidence of the relationship between support received through Waiver Services and satisfaction with family quality of life. Ongoing research through longitudinal study is needed to advance our understanding of appropriate services and service delivery methods as they impact progress and function when working with families and their children with ASD.

287 **144.287** Multi-Disciplinary Team Work in Israeli ASD-Preschools: What Does It Take for a Whole to be Greater Than the Sum of Its Parts?

Y. Sinai-Gavrilov[1], *T. Gev*[1,2], *I. Mor Snir*[2] *and O. Golan*[1], *(1)Department of Psychology, Bar-Ilan University, Ramat-Gan, Israel, (2)Association for Children at Risk, Givat-Shmuel, Israel*

Background: Best-practice guidelines for early-intervention in Autism Spectrum Disorder (ASD) call for intensive and comprehensive interventions. The Israeli special education system for preschoolers with ASD promotes an integrative-developmental model of treatment for ASD. Children attending these settings receive a 14-hour-per-week treatment package from multiple professionals, including occupational therapists, speech and language pathologists, psychologists, art and music therapists, physiotherapists and behavior analysts. These treatments are embedded in the preschool routine, which includes one-on-one and group educational interventions. This integrative model is based on the premise that no single early intervention approach was found to be the most effective in promoting development, and therefore, young children with ASD should benefit from an individualized treatment-plan that builds on elements from various disciplines.
Objectives: This study aims to examine the perspectives of professionals from different disciplines working in ASD preschools, with regards to the preschool staff's integrative work and cooperation in their settings. Using a qualitative approach, we have explored the various factors that influence the experience of collaboration and cohesion among staff members, and its relation to their perceived professional efficacy.
Methods: Twenty-four professionals working in preschools for children with ASD were given semi-structured interviews, focusing on their experience as part of a specialized multidisciplinary team in ASD preschools. The interviewees (21 females, 3 males) varied in their professional background (7 psychologists, 5 speech and language pathologists, 4 occupational therapists, 3 physiotherapists, 3 behavior analysts, 3 art and music therapists), age (M=30.1, range - 29-36), and years of experience in the field of ASD (M=2.7 years, range 1-7). Interviews were transcribed and content analysis was performed.
Results: Primary analysis revealed that the staff's collaborative dialogue plays a significant role in the professionals' satisfaction and their perceived ability to bring to favorable outcomes among treated children. Several themes emerged as influential on the perceived cohesion of the professional staff: the importance of a shared terminology and conceptual framework with regards to children with ASD and their families, with a psychodynamic terminology vs. an adaptive functioning terminology as the main competing frameworks; the staff's ability to maintain equal member participation in discussion and decision making; the staff's ability to bridge between the therapeutic and educational demands and their individual perspectives on intervention; the professionals' attitude towards learning and applying practices which pertain to different disciplines; and the robustness of the staff-member's own professional identity.
Conclusions: Our findings offer a wider understanding of the factors that support an inter-disciplinary dialogue, decision making, and collaboration in ASD preschool staff. These elements are of particular importance in settings promoting integrative intervention approaches when no single comprehensive treatment model is preferred. An association between the nature of the staff's dialogue, and the individual practitioner's self and professional efficacy is suggested.

Poster Session
145 - Miscellaneous
12:00 PM - 1:40 PM - Golden Gate Ballroom

288 **145.288** Evaluating Long-Term Effects of an Early Detection Program for Autism Spectrum Disorder in the Netherlands

M. K. J. Pijl[1,2], *J. K. Buitelaar*[1,2], *M. W. P. de Korte*[1,2], *N. N. J. Rommelse*[2,3] *and I. J. Oosterling*[1,2], *(1)Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen Medical Centre, Nijmegen, Netherlands, (2)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands, (3)Department of Psychiatry, Radboud University Nijmegen Medical Centre, Nijmegen, Netherlands*

Background: The importance of early detection of autism spectrum disorder (ASD) followed by early intervention has been increasingly emphasized for children's adaptive, social and cognitive functioning. Early detection programs have demonstrated to lower the age at diagnosis directly after implementation. However, long-term effects are largely unknown. This study aimed to evaluate the long-term effects of an early detection program, training primary care providers and using a systematic screening procedure, applied by Oosterling et al. (2010), after a freeze of active investment.
Objectives: To investigate the long-term effects of an early detection program for ASD on the age at referral compared to non-ASD diagnoses.
Methods: The early detection program encompassed (a) training of primary care providers to recognize early signs of autism, (b) use of a systematic screening protocol including the Early Screening of Autistic Traits questionnaire, and (c) formation of a multidisciplinary diagnostic team. The effectiveness of the program was evaluated by a controlled study involving ASD (N=513) and non-ASD (N=722) referrals (aged 0-6 years) across three periods: pre-implementation (PRE; status quo), implementation (IMPL; actual implementation), and post-implementation (POST). During POST the multidisciplinary team continued to provide highly specialized mental health care service for infants and toddlers, but there was no specific effort put into training of primary care providers and use of the screening protocol. The proportion of children referred < 36 months of age versus the proportion of children 3-6 years was used as the outcome measure in binary logistic regression modeling. Predictors included diagnosis (ASD vs. non-ASD) and time point (PRE, IMPL, POST).
Results: There was a significant diagnosis by time point interaction effect (Wald chi-square (2) = 7.898, *p*= .019). The odds of being referred before 36 months for ASD versus non-ASD was stronger during implementation, but not before or after implementation (IMPL vs. PRE: 3.1, 95% CI 1.2-7.6; IMPL vs. POST: 1.7, 95% CI 1.0-3.0; PRE vs. POST: non-significant), with 33.3% (vs. 66.7%), 58.7% (vs. 41.3%) and 42.9% (vs. 57.1%) of the cases being referred for ASD during PRE, IMPL and POST, respectively. Post-hoc analyses revealed that the ASD referrals were 3.8 times (95% CI 1.8-7.9) and 4.0 times (95% CI 2.7-6.0) more likely to be referred before 36 months during IMPL as compared to PRE and POST, respectively. No significant differences were found between PRE and POST. In contrast, non-ASD referrals were only 2.3 times (95% CI 1.6-3.3) and 1.9 times (95% CI 1.1-3.3) more likely to be referred before 36 months during IMPL and PRE, respectively, as compared to POST. No significant differences were found between PRE and IMPL.
Conclusions: The early detection program led to earlier referral of children with ASD when corrected for other referrals during that time period, but this effect was not sustained when active investment was ended. This study highlights the importance of ongoing investment and encourages policy makers and health care managers to overcome barriers after implementation.

289 **145.289** Dysregulated Microbiome in People and Mice with Autism-Associated Genetic Mutations

*L. Tabouy[1], O. Ziv[1], O. Koren[1] and **E. Elliott**[2], (1)Bar Ilan University, Safed, Israel, (2)Bar-Ilan University, Safed, ISRAEL*

Background: The gut microbiome may influence brain development and behavior, mainly through the modulation of physiological metabolism and the immune system. Recent studies have highlighted a possible role for microbiome dysregulation in the development of autism spectrum disorders. However, according to current data, over half of the risk of autism is due to genetics. Therefore, knowledge of the interaction between the genetic disposition to autism and the microbiome is necessary to understand the exact role of microbiome in autism development.
Objectives: Our main objectives are to determine the dysregulation of the microbiome in people with the autism associated chromosome 16p11.2 deletion, as well as microbiome dysregulation in the chromosome 16 deletion mouse model. A second objective was to determine the dysregulation of microbiome in the Shank3 mouse model and to correlate microbiome dysregulation to immune dysregulation.
Methods: Using 16S high-throughput sequencing of stool samples, we have determined the gut microbiome community of 26 individuals with the chromosome 16p11.2 deletion, and their non-affected siblings. Real Time PCR is used to verify dysregulation of specific bacterial species in the people, and to study their dysregulation in the mouse model. 16S high-througput sequencing was also performed on stool samples from Shank3 knockout mice. The immune system profile of the mice was performed to determine the correlation between microbiome dysregulation and immune dysregulation.
Results: We have identified specific bacteria which are increased in individuals with the chromosome 16p11.2 deletion. In addition, we have found that some of these species are also dysregulated in the chromosome 16p11.2 deletion mouse model, further suggesting that genetic changes directly lead to microbiome dysregulation. In the case of the shank3 mice model, we verified the dysregulation of several bacterial genus and species by real-time PCR. Some of these species overlapped with those found in the individuals with chromosome 16p11.2 deletion. Of particular interest, we found that a few specific species within the bacterial genus lactobacillus, which has previously been implicated in social behavior, is dysregulated in all of our experimental groups (people with chromosome 16p11.2 deletion and both mouse models included in this study) In addition, we identified a correlation between levels of specific bacterial species and dysregulation of blood cytokine levels, as well as neurotransmitter receptor levels in the brain.
Conclusions: These studies determine that genetic differences associated with autism can induce changes in the microbiota profile. While most work has focused on the role of the microbiome in environmental factor-induced susceptibility to autism, this study highlights the role of genetics in establishing the microbiome. These studies will further help us understand the role of the microbiome in autism and if probiotics may helpful in a subset of affected individuals.

290 **145.290** Performance-Based Social Skills Training Improves Treatment Outcomes for Youth with Comorbid ADHD or Anxiety

***A. H. Gerber**[1], E. Kang[2], A. Mulhall[1], T. Clarkson[1] and M. D. Lerner[2], (1)Psychology, Stony Brook University, Stony Brook, NY, (2)Stony Brook University, Stony Brook, NY*

Background: Group-based social skills interventions (GSSIs) are a widely-used efficacious treatment modality for children with autism spectrum disorder (ASD; Gates et al., 2016) that typically provide training rules for interaction (social knowledge), enriched social contexts (social performance), or both (Lerner & Mikami, 2012). There is a need to investigate comorbidity as a potential moderator of treatment outcomes, as it is common in youth with ASD (Simonoff et al., 2008; Lerner & White, 2015). Specifically, attention-deficit/hyperactivity disorder (ADHD) and anxiety have been linked to deficits in social skills (Barkley, 1997; Motoca et al., 2012). Research utilizing a social knowledge approach to GSSIs has found little differential benefit for youth with any comorbidity (Deckers, et al., 2016), and limited gains for youth with comorbid ADHD compared to comorbid anxiety and ASD alone (Antshel et al., 2011). As they may already exhibit intact social knowledge (e.g., Maedgen & Carlson, 2000), youth with comorbid ADHD and anxiety might particularly benefit from a social-performance training that allows them to practice skills in vivo, as compared to a social-knowledge training; however, this has never been examined.
Objectives: We examined the impact of psychiatric comorbidity on treatment response to a community-based GSSI that provides an enriched, in vivo social learning and practice opportunities for ASD youth (Lerner et al., 2011).
Methods: Seventy-five children and adolescents, ages 9 to 17 years (M=12.86 years, SD=2.19; 59 male) participated in a 6-week community-based summer GSSI. The majority of parents reported a diagnosis of ASD for their child (86.7%). Parents completed measures of broad psychopathology (BASC-2; Reynolds & Kamphaus, 2004) and ASD symptomatology (SRS; Constantino & Gruber, 2007) at baseline and endpoint.
Results: Using ANCOVA-of-change, presence of any comorbid psychiatric diagnosis was associated with improvements on the BASC-2 behavioral symptom index and externalizing problems, specifically in aggression and conduct problems (all $\beta<=-.21$, $p<=.05$). In addition, the presence of a comorbid ADHD diagnosis was associated with reduced BASC-2 behavioral symptoms and externalizing problems (all $\beta<-.28$, $p<.049$), and improved adaptive skills, notably in social skills and daily living activities (all $\beta>.29$, $p<.01$). Finally, presence of a comorbid anxiety diagnosis was associated with greater improvements on the SRS, driven by improvements in social awareness and cognition (all $\beta<-.23$, $p<.04$).
Conclusions: As hypothesized, the presence of a comorbid psychiatric disorder moderated the treatment outcomes for youths participating in a GSSI. Consistent with previous research, participants with anxiety made larger gains on the SRS compared to other participants (Antshel et al., 2011). Unlike previous studies, youth with comorbid ADHD showed augmented improvements in externalizing problems and improved their adaptive skills. This suggests that GSSIs employing social-performance approaches can be particularly beneficial for youth with ADHD. This is supported by recent research indicating that impaired social decision-making mediated the relationship between ADHD symptoms and social skills deficits for youth with ADHD (Humphreys, Galan, Tottenham, & Lee, 2016). Future research should examine the mechanisms of change for performance training GSSIs, which may further elucidate unique benefits for those with comorbid ADHD.

Oral Session - 6A

146 - Maternal Factors that Impact the In Utero Environment and Autism-related Outcomes

1:45 PM - 2:35 PM - Yerba Buena 3-6

Session Moderator: Jeremy Veenstra-Vander Weele, *Psychiatry, New York State Psychiatric Institute / Columbia University, New York, NY*

1:45 **146.001** Maternal SSRI Exposure Results in Developmental and Long-Term Social Behavior Disruptions in Offspring.

S. E. Maloney, *S. Akula, K. B. McCullough, K. Chandler, C. Jakes, S. Avdagic, M. A. Rieger and J. Dougherty, Genetics, Washington University School of Medicine, St. Louis, MO*

Background: Six recent epidemiologyÂ studies found a significant association between maternal antidepressant (AD) use, particularly Selective Serotonin Reuptake Inhibitors (SSRIs), and increased risk of autism spectrum disorder (ASD) in the offspring. The heightened risk of ASD diagnosis was independent of mothers' depressive symptoms, indicating the risk is mediated by exposure to the drug. Two more studies reported a significant association with ASD and maternal AD use prior to but not during pregnancy, while another two reported no significant increase in ASD risk following maternal AD use. Thus, while on the balance more of these retrospective human studies implicated SSRI exposure as a risk factor, the debate would be strongly informed by explanatory studies in a model organism to identify whether mechanisms exist for long-term behavioral disruptions due to maternal SSRI use. Animal studies in particular allow for precise experimental control of exposures, and can provide clear indication as to whether transient SSRI exposure can alter long-term social behavior in placental animals.
Objectives: The objective of this study was to model in the rodent the recent human patient population findings to directly examine the risk of presenting ASD-relevant behaviors following maternal SSRI exposure during pregnancy and lactation and to elucidate molecular and cellular mechanisms in the brain.
Methods: Pregnant C57BL/6J female mice were exposed to the SSRI fluoxetine (FLX) via drinking water at a dose approximately equivalent to the maximum recommended human dose. The developmental and behavioral consequences in the offspring were examined, as well as cellular morphology and cell-specific transcriptional changes. Maternal FLX exposure began prior to breeding and continued through pregnancy and lactation until the pups were P14. To examine critical exposure periods, dams were also exposed only until birth (P0) or until E16 (equivalent to first trimester of human brain development). We examined possible interactive effects on behavior of FLX exposure and genetic susceptibility by exposing mothers of *Celf6* mutants, which exhibit a partial ASD-like phenotype (Dougherty, Maloney et al. 2013).
Results: Compared with vehicle-exposed controls, maternal FLX exposure resulted in robust long-term social behavior disruptions. During early postnatal ages, FLX exposure robustly attenuated USV calls and decreased weight. Altered social behaviors were observed in FLX-exposed pairs during juvenile play. In adulthood, impaired sociability and robustly altered social dominance were observed in FLX-exposed mice. Only when FLX exposure extended to P14 were behaviors altered in the T-maze and marble burying task. In the genetically vulnerable line, FLX exposure and *Celf6* mutation acted separately but in the same manner on developmental and long-term behaviors. Dendritic morphology and cell-specific gene expression were examined at ages coinciding with early social communicative deficits (P9) and later sociability and dominance changes (P60).
Conclusions: Maternal SSRI exposure in the C57BL/6J mouse leads to social communicative deficits in pups and long-term social behavior deficits. The influence of drug exposure on repetitive patterns of behavior may be dependent on age at exposure, specifically postnatal exposure through lactation. This study may have implications for the safety of antidepressant use in pregnant women and further research is needed.

1:57 **146.002** Maternal Antibodies in Autism Spectrum Disorder: Isolation and Specificity

L. Brimberg[1], *S. Mader*[1], *V. Jeganathan*[2], *T. R. Coleman*[2], *P. Gregersen*[2], *P. T. Huerta*[2], *B. Volpe*[2] *and B. Diamond*[3], *(1)Center for Autoimmune and Musculoskeletal Diseases, The Feinstein Institute for medical Research, Manhasset, NY, (2)The Feinstein Institute for medical Research, Manhasset, NY, (3)The Feinstein Institute for Medical Research, Manahasset, NY*

Background:
The concept thatÂ in utero environment, specifically maternal antibodies can contribute to the development of Autism spectrum disorders (ASD) has been entertained for over a decade, but only recently specific antibodies have been identified. Studies, including our own, have shown that significantly more mothers of children with ASD have brain-reactive antibodies than unselected women of child bearing age or mothers of a typically develop child. The hypothesis is that these anti-brain antibodies exploit the natural mechanism of immune protection of the fetus, cross the placenta, and, at a time when the fetal brain is not protected by a competent blood brain barrier, they can perturb fetal brain development. Indeed, several studies showed that mice or monkeys exposed in utero to such antibodies demonstrate 'ASD'-like phenotype.
Objectives:
We opted to generate brain-reactive monoclonal antibodies from mothers with an ASD child, to study their antigenic specificities, contribution to ASD pathogenesis and to device a protection strategy.
Methods:
We generated anti-brain monoclonal antibodies by first separating memory (CD27+) B cells from the blood of women with a child with ASD previously shown to have brain-reactive antibodies. We then incubated CD27+ B cells with fetal human brain homogenate labeled with biotin, followed by fluorochrome tagged stretavidin. B cells bound to fetal human brain antigens were isolated. Single CD27+ B cells were then isolated and immunoglobulin heavy and light chain variable region genes were amplified by PCR and expressed in vitro. We determined antigenic specificity of brain reactive monoclonal antibodies using a human protein array and a cell based assay. We determined pathogenicity by analyzing brain and behavior of the offspring following in uterine exposure to a monoclonal antibody cloned from a mother of an ASD child.
Results: We have generated a panel of brain-reactive monoclonal antibodies. Three monoclonal antibodies from 3 different mothers were found to bind the extracellular domain of contactin-associated protein-like 2 (Caspr2). We assessed the pathogenic potential of one of those monoclonal antibodies, C6. We intravenously administered either non-brain reactive control antibody B1 or C6 to pregnant mice on Embryonic day (E)13.5. We demonstrate that male but not female mice exposed in utero to the C6 monoclonal antibody display abnormal cortical development at E15.5 with a thinner cortical plate and a reduced number of proliferating cells. At adulthood, the brain exhibits decreased dendritic complexity of excitatory neurons and reduced numbers of inhibitory neurons in the hippocampus, and the live offspring exhibit impairments in sociability, flexible learning, and repetitive behavior. We suggest that this effect might cause by antibody mediated early internalization of AMPA receptors. We further demonstrated that anti-Caspr2 antibodies are more frequent in women with brain-reactive serology and a child with ASD
Conclusions:
We show in a mouse model that exposure in-utero to a monoclonal anti-brain reactive antibody isolated from a mother of an ASD child induces neurodevelopmental effects in the offspring that can be observed already during the embryonic stage. Currently we are designing a strategy to protect the developing fetus from the harmful effect of anti-Caspr2 antibodies.

2:09 **146.003** Maternal and Fetal Genetic Control of Mid-Gestational and Neonatal Levels of Markers of Immune Function

L. Weiss[1], *L. S. Heuer*[2], *M. Traglia*[1], *C. Yoshida*[3], *R. Hansen*[4], *R. Yolken*[5], *O. Zerbo*[6], *J. Van de Water*[7], *G. C. Windham*[8], *M. Kharrazi*[8], *G. N. Delorenze*[3], *P. Ashwood*[9], *L. A. Croen*[3] *and K. L. Jones*[7], *(1)Department of Psychiatry and Institute for Human Genetics, University of California San Francisco, San Francisco, CA, (2)University of California, Daivs, CA, (3)Kaiser Permanente Division of Research, Oakland, CA, (4)UCD MIND Institute, Sacramento, CA, (5)Johns Hopkins University School of Medicine, Baltimore, MD, (6)Kaiser Permanente, Oakland, CA, (7)University of California at Davis MIND Institute, Davis, CA, (8)Environmental Health Investigations Branch, California Department of Public Health, Richmond, CA, (9)UC Davis, Sacramento, CA*

Background:
The immune system plays an important role in neurodevelopment, and increasing evidence suggests a link between immune system dysregulation and autism spectrum disorder (ASD). Animal models show that maternal immune activation during gestation impacts fetal brain development and subsequent behavior, potentially driven by alterations in levels of cytokines and chemokines which serve as Soluble Immune Mediators (SIMs). We therefore aimed to assess whether levels of SIMs during pregnancy or at birth might be determined by maternal and/or fetal genetics, and thus influence ASD risk beyond the presence of infection.
Objectives:
To determine whether maternal and neonatal immune markers are regulated by genetics in addition to environmental immune stimulation.
Methods:
We utilized a multi-ethnic genotyped population-based nested case-control study of 790 women and 764 of their newborns (390 ASD cases, 400 controls) in the EMA (Early Markers of Autism) study (Croen, Autism Res 2008; Tsang, PLoS ONE 2013). Mid-gestational levels of 22 SIMs were measured in maternal serum, and 42 in neonatal bloodspots. We first estimated the maternal and neonatal genome-wide SNP-based heritability (h^2_g) for each SIM and then performed GWAS using linear regression to identify specific loci contributing to individual SIMs. Finally, we assessed the relationship between genetic SIM determinants and ASD outcome.
Results:
Levels of two maternal SIMs showed > 80% maternal heritability (P<0.05, each) and the levels of 4 separate neonatal SIMs showed > 50% neonatal heritability in a SNP-based model (Yang, Nat Genet 2010) adjusted for genetic ancestry, maternal sociodemographic confounding factors as well as offspring affection status. Genome-wide association revealed 19 independent loci associated with 27 SIMs (P<5x10^{-8}): 3 maternal alleles were associated with maternal SIMs, 3 maternal alleles were associated with neonatal SIMs, 1 neonatal allele was associated with maternal sIL2Ra, and 12 neonatal alleles were associated with neonatal SIMs. Thus, not only can maternal genetics influence immune markers during pregnancy and in her infant, but fetal genetics can influence maternal immune markers mid-gestation as well as neonatal immune markers immediately after birth. The specific genetic loci highlight the pleiotropic contribution of a neonatal locus mapping to *PLCL2*, (P_{min}=8x10^{-21}), previously associated with autoimmune diseases. Maternal CCL2 and maternal and neonatal IL-8 were nominally associated with offspring affection status (P<0.05, each). Of these, neonatal IL-8 showed a suggestively associated locus that interacts with ASD status and maps to chromosome 2 (with no nearby genes) (rs55823040; P=4x10^{-7}). Thus, association between neonatal IL-8 levels and ASD outcome appears only within one genotype class at this IL-8 associated SNP.
Conclusions:
Our results demonstrate strong mutual contribution of both maternal and neonatal genetics to maternal and neonatal SIMs, however further research is required to elucidate roles in the development of ASD.

2:21 **146.004** Maternal Whole Blood Serotonin Levels Are Inversely Correlated with Social Difficulty, Language Impairment, and Repetitive Behavior in Offspring with Autism Spectrum Disorder.

A. K. Montgomery[1,2,3], *L. C. Shuffrey*[1,4,5,6], *S. J. Guter*[7], *G. M. Anderson*[8], *S. Jacob*[9], *E. H. Cook*[10] *and J. Veenstra-Vander Weele*[1,4,5,11], *(1)Department of Psychiatry, Columbia University Medical Center, New York, NY, (2)New York Presbyterian Hospital - Westchester Division, Center for Autism and the Developing Brain, White Plains, NY, (3)Department of Child & Adolescent Psychiatry, New York State Psychiatric Institute, New York, NY, (4)Department of Child and Adolescent Psychiatry, New York State Psychiatric Institute, New York, NY, (5)Center for Autism and the Developing Brain, New York-Presbyterian Hospital, White Plains, NY, (6)Teachers College, Columbia University, New York, NY, (7)University of Illinois at Chicago, Chicago, IL, (8)Yale University School of Medicine, New Haven, CT, (9)University of Minnesota, Minneapolis, MN, (10)Psychiatry, University of Illinos at Chicago, Chicago, IL, (11)Weill Medical College of Cornell University, Sackler Institute for Developmental Psychobiology, New York, NY*

Background: Â
Biomarker, neuroimaging and genetic findings implicate the serotonin (5-HT) system in autism spectrum disorder (ASD). Several groups have investigated clinical correlates of 5-HT levels in ASD, with minimal and inconsistent findings across studies. Recently, we identified an impact of the maternal 5-HT system on embryonic forebrain 5-HT levels and neurodevelopment in mice (Muller et al., in press).
Objectives:
As an initial step in evaluating the contribution of the maternal 5-HT system to ASD risk, we hypothesized that mothers' serotonin levels would correlate with the clinical presentation of ASD in their offspring.
Methods: Â
Whole blood serotonin (WB5-HT) levels were obtained from 184 children diagnosed with Autistic Disorder, Asperger's Disorder, or Pervasive Developmental Disorder Not Otherwise Specified based on DSM-IV-TR criteria, as well as from 90 of their fathers and 105 of their mothers. The child social and repetitive behavior phenotypes were evaluated using the Autism Diagnostic Observation Schedule (ADOS-2, Lord et al., 2012). Language function was examined using the Peabody Picture Vocabulary Test (PPVT-4, Dunn & Dunn, 2006) and the Expressive One-Word Picture Vocabulary Test (EOWPVT-4, Martin & Brownell, 2000). Finally, adaptive function was assessed using the Vineland Adaptive Behavior Scale (VABS-2, Sparrow, Cicchetti & Balla, 2005). Participants or parents receiving medications influencing the 5-HT system, such as serotonin reuptake inhibitors, were excluded from analysis. Whole blood samples obtained by venipuncture were stored in Vacutainer tubes containing EDTA at -70° C, prior to WB5-HT assay by high-performance liquid chromatography.
Results:
Proband WB5-HT levels correlated with both maternal WB5-HT levels (r_s(99)=0.291, p=0.003) and paternal WB5-HT levels (r_s(88)=0.385, p=0.0002). Despite these within family correlations, maternal WB5-HT levels were significantly correlated with child social, language, and repetitive behavior phenotypes; whereas paternal WB5-HT levels and proband levels were not. Maternal WB5-HT levels were negatively correlated with ADOS-2 total scores of social affect (r_s(103)=-0.258, p=0.008), total scores of restricted and repetitive behavior (r_s(103)=-0.254, p=0.009) and overall ADOS-2 scores of social affect and restricted, repetitive behavior (r_s(103)=-0.300, p=0.002). Maternal WB5-HT levels correlated with language raw scores on the PPVT-4 and EOWPVT-4 (r_s(71)=0.386, p=0.001 and r_s(62)=0.421, p=0.001, respectively). Finally, maternal WB5-HT levels correlated with overall adaptive functioning on the VABS-2 (composite standard score, r_s(99)=0.268, p=0.007), and with standard scores in the communication and living skills domains (r_s(99)=0.291, p=0.003 and r_s(99)=0.328, p=0.001, respectively).
Conclusions:
We found that higher levels of maternal WB5-HT levels were associated with lower impairment in social and repetitive behavior, as well as higher language scores, reflecting less communication impairment in children with ASD. Work is ongoing to replicate these findings and assess whether maternal 5-HT levels define a specific subgroup of children with ASD. Future studies using animal models and longitudinal neuroimaging are needed to understand the mechanisms underlying these associations.

Oral Session - 6B
147 - Epidemiology: Risks and Prevalence
2:40 PM - 3:30 PM - Yerba Buena 3-6

Session Moderator: Craig Newschaffer, *Drexel University A.J. Drexel Autism Institute, Philadelphia, PA*

2:40 **147.001** Maternal Insecticide Exposure during Pregnancy and Risk of Autism in Offspring from a National Birth Cohort

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Background: Dichlorodiphenyl dichloroethene (DDE) is a metabolite of the insecticide DDT and is a persistent organic pollutant. Despite declining levels with time, ongoing prenatal exposure potential exists for nearly all children. DDE is transferred across the placenta, demonstrated by high correlations between levels of this pollutant in maternal serum and placenta and maternal and cord serum. Maternal prenatal serum DDE levels have been correlated with lower scores on standardized early childhood neurocognitive tests and low birthweight.
Objectives: We sought to examine whether elevated maternal DDE levels during pregnancy were related to an increased risk of childhood autism in a large sample of offspring from a national birth cohort.
Methods: The study is based on a nested case-control design. Cases with autism were identified from the national Finnish Hospital Discharge Registry and linked to the Finnish Maternity Cohort, which includes archived maternal serum specimens from virtually all pregnancies in Finland (over 1.5 million). Cases were born from 1987-2005 and followed up until 2007. Cases were matched 1:1 to controls drawn from the birth cohort who were without ASD (N=750 matched pairs) on date of birth, sex, birthplace, and residence in Finland. The samples were assayed for DDE using gas chromatography tandem mass spectrometry (GC-MS/MS). In each batch of samples a control serum sample from the National Institute of Standards and Technology was included. In previous work the detection rate for DDE was >96%. DDE was classified as a dichotomous variable, with the cut-point at the 75th percentile of the control distribution. Data were analyzed using conditional logistic regression for matched pairs.
Results: In a preliminary analysis we demonstrated that maternal exposure to DDE levels in the highest quartile are associated with a 41% increased risk of childhood autism (OR=1.41, 95% CI=1.11-1.80, p=0.005). We will also present results from assays of polychlorinated biphenyls (PCBs) in maternal serum samples of autism cases and controls, and from multivariate analyses adjusting for covariates. In addition, we shall report findings on whether the association between maternal DDE and autism is mediated by perinatal complications and increased growth velocity of head circumference.
Conclusions: We found an increased risk of autism among subjects who were exposed during pregnancy to elevated levels of DDE, a metabolite of DDT. These preliminary data suggest that prenatal exposure to this insecticide is related to the risk of autism in offspring. Strengths of the study include a large, population-based, national sample and prospective measures of exposure. Since this persistent organic pollutant has been related to neurocognitive and other early life abnormalities, this work may ultimately lead to an improved understanding of the neurodevelopmental mechanisms that underlie autism and suggest preventive strategies.

2:52 **147.002** Prevalence of Autism Spectrum Disorders Among Young Adults in Union County, New Jersey

W. W. Zahorodny[1], *A. Fusco*[2], *J. Shenouda*[3], *M. Waale*[2] *and A. E. Mars*[4], *(1)New Jersey Medical School, Westfield, NJ, (2)Rutgers - NJ Medical School, Newark, NJ, (3)Rutgers University, Newark, NJ, (4)Hunterdon Regional Autism Center, Yardley, PA*

Background:
Minimal data currently exist regarding the prevalence of Autism Spectrum Disorders (ASD) in young adults, rendering planning for, access to, and implementation of medical and daily living services for adults with ASD both inefficient and ineffective, at best. A study of ASD prevalence in a community sample of adults in the United Kingdom (UK) identified an ASD rate of 1% across all ages of adults, consistent with the rate in children (Brugha et al., 2011). Additional epidemiologic studies of ASD in adults are needed, especially in the United States, where ASD rates have increased significantly among children.
Objectives:
To estimate ASD prevalence and to describe the expression of ASD in a cohort of young adults born in 1988 and residing in Union County, New Jersey (NJ) in 2006, using the Centers for Disease Control and Prevention (CDC) Autism and Developmental Disabilities Monitoring (ADDM) Network population-based method of prevalence determination.
Methods:
This study used the ASD ascertainment strategy of the CDC ADDM Network, described previously in the *Morbidity and Mortality Weekly Report (MMWR) Series* (Rice, 2007) and replicated repeatedly in biannual surveillance cycles. The ADDM Network methodology uses an active, multi-phase method, consisting of independent review, abstraction and analysis of medical and educational records. The study used consistent DSM-IV-TR definitions of ASD.
Results:
In a population of 6,865 young adults born in 1988 and residing in Union County NJ, in 2006, 40 individuals with ASD were identified, indicating ASD prevalence of 5.8 per 1,000 (95% confidence interval [CI] = 4.27-7.94). Significant differences were found in prevalence between males, 9.23 per 1,000 (CI=6.56-12.98) and females, 2.13 per 1,000 (CI=1.01-4.47). ASD prevalence was lower in Hispanic individuals than in Whites or Blacks: White, non-Hispanic 6.7 per 1,000 (CI=4.37-10.27); Black, non-Hispanic 5.6 per 1,000 (CI=3.01-10.4); Hispanic 1.8 per 1,000 (CI= 0.58-5.59). Nineteen of 40 (47.5%) cases had a documented ASD diagnosis by a community provider. Six of 40 (15%) cases received special education services under the Autism Classification. Among the young adults identified with ASD at age 18, 45% (n=18) had a co-morbid psychiatric or neurological disorder.
Conclusions:
ASD prevalence among 18-year olds was consistent with the two epidemiologic estimates for the cohort and period, but lower than expected, when compared to ASD estimates from later NJ cohorts, for example: 9.9 per 1,000 and 10.6 per 1,000 for cohorts born in 1992 and 1994. The findings suggest increasing ASD prevalence over time. Study findings also indicate the possibility of sex and race-based disparities and a significant proportion of undiagnosed/unrecognized young adults with ASD.

3:04 **147.003** Determinants of Autism Prevalence in Hispanics

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Background: Hispanic children have a lower rate of autism spectrum disorder (ASD) diagnosis compared to non-Hispanic counterparts according to U.S. surveillance data. Underlying explanations for this significant disparity in ASD prevalence are poorly understood.
Objectives: This investigation aims to determine whether the lower prevalence of autism among California Hispanics can be explained by specific demographic and / or clinical factors.
Methods: This retrospective cohort study includes births drawn from the Office of Statewide Health Planning and Development PDD-Birth files from 01/01/1991-12/31/2008 that survived their first year of life. Children diagnosed with autism between 1991 and 2012 by the California Department of Developmental Services (DDS) were identified (n=33,359). The remainder of the birth cohort served as controls (n= 6,897,246). Demographic variables and ICD-9-CM codes for medical diagnoses and procedures during pregnancy were assessed for confounding. Logistic regression models evaluated the relationship between ethnicity and autism, controlling for parental age and education, maternal diabetes and preeclampsia, child sex, gestational age, delivery payer, delivery mode, and multiple gestations.
Results: While crude analyses found that Hispanic children were 27% less likely to have autism compared with their Non-Hispanic counterparts, autism odds were actually 14% higher for Hispanic children in models adjusted for clinical and demographic factors (OR 1.14, 95% CI 1.11, 1.18). Similarly, crude odds of autism were 35% lower in Hispanic children with foreign-born parents, and again the association reversed with proper adjustment to parallel the primary analysis (OR 1.15, 95% CI 1.11, 1.20).
Conclusions: Our investigation reinforces the importance of careful adjustment for confounders in assessing epidemiologic risk. Social determinants greatly influence health disparities. The influence of pregnancy complications known to enhance autism susceptibility played a substantial role in this analysis, but more striking still was the impact of low parental educational attainment – a proxy for socioeconomic status – on autism risk in Hispanics. Parents with more restricted education may not fully understand the implications of neurobehavioral differences in their children. Those who seek help may face major obstacles advocating for their child and accessing much-needed health and educational resources. These hurdles may be more daunting for foreign-born Hispanic parents who may also face language barriers and hold accentuated cultural views.

3:16 **147.004** Parent-Report Delays in Diagnosis and Service Initiation for African-American Children in a Multi-Site National Study

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Background: To the best of our knowledge, the true prevalence of ASD does not vary by race, yet detection rates of ASD are 20% higher in White non-Hispanic children (1 in 65) versus African-Americans (1 in 76) (CDC, 2016). U.S. surveillance research found that African-American and Hispanic children were more likely than White children to have a documented developmental concern before the age of 3 years, yet they were less likely to receive an evaluation before 36 months, (CDC, 2016).
Objectives: This study explored the variability in autism identification pathways for families with African-American children focusing on three key events: a) first concerns and help seeking, b) first autism diagnosis, and c) start of special services. We developed an interview tool using EHCI methods to enhance accuracy of parent/caregiver recall regarding their experiences seeking an ASD diagnosis and services for their child. This *Diagnostic Odyssey*instrument (Shattuck et al. 2013) seeks to capture and quantify barriers to quality treatment, medical care, diagnosis of autism spectrum disorders, and service seeking experiences for African-American and minority families.
Methods: Â The sample was comprised of 312 African-American and bi-racial African-American children (251 male, 61 female) enrolled in the *Autism Genetics Network, Phase II, Increasing the Representation of Human Diversity*at four sites: Washington University in St. Louis (N=147), Emory University in Atlanta, Georgia (N=54), Albert Einstein University in Bronx, New York (N=41), and University of California, Los Angeles (N=70). Participants were diagnosed with or strongly suspected of having an autism spectrum disorder (275 diagnosed ASD; 37 suspected-ASD). Median household income was $36,500 for the ASD-diagnosed group, and $28,000 for the suspected-ASD group.
Results: Â In the diagnosed group (N=275), the mean age parents reported first concerns with their child's language, behavior or development was 21.4 months (SD=17.8), and they reported sharing concerns with a professional by a mean age of 27.1 months (SD=22.6). However, the mean age of receiving an official autism spectrum diagnosis in this group was not until 54.4 months (SD=36.3). In comparison, mean age of first concerns in the suspected ASD group (N=37) was 35.1 months (SD=26.2); mean age at the time of the research evaluation was 148.3 months (SD=75.9), with an average delay of 114.1 months (SD=75.2) between age of initial concern and identification of an ASD by research diagnosis. All parents of children suspected of having an ASD reported sharing concerns with a professional, mean age =42.0 months (SD=28.4), however only 46.0% of these children had been assessed for an ASD prior to study enrollment (mean age 91.0 months, SD=51.4). Seventy-six percent of children suspected of having an ASD diagnosis met DSM criteria based on a clinical best estimate research evaluation at the time of the study.
Conclusions: The findings of this study reveal continued concerns with delays in autism evaluations for African American children despite parents expressed concerns to professionals. This research can help us to guide interventions that may decrease the delay in diagnosis and adequate treatments for African-American children with autism spectrum disorders.

Oral Session - 7A
148 - Developmental Processes of Distinct Repetitive and Sensorimotor Behaviors
1:45 PM - 2:35 PM - Yerba Buena 7

Session Moderator: Matthew W. Mosconi, *University of Kansas, Lawrence, KS*

1:45 **148.001** Examining Cognitive Inflexibility and Anxiety in Relation to Restricted, Repetitive Behaviours in Autism Spectrum Disorders in a Large Multi-Site Study

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Background:
Restricted and repetitive behaviours (RRBs) are core features of autism spectrum disorder (ASD). Previous studies have suggested distinct subtypes of RRBs, such as 'lower-order' (e.g. motor stereotypies) and 'higher-order' RRBs (e.g. restricted interests and insistence on sameness; Turner, 1999; Rutter et al., 2003). Despite various descriptions of RRBs, their origins are less well understood. This may be because: (1) different facets of RRBs have different underpinnings; or (2) the same facet has different underpinnings in different individuals. As an example: for some, cognitive inflexibility may underlie insistence on sameness (D'Cruz et al., 2013), whereas for others, anxiety in uncertain situations may be a factor (Lidstone et al., 2014).
Objectives:
(1) To examine the profile and severity of RRBs in children, adolescents and adults who participated in the EU-AIMS Longitudinal European Autism Project (LEAP); and (2) to investigate cognitive inflexibility and anxiety as possible underpinnings of RRBs.
Methods:
Participants were 431 individuals with ASD aged 6-30 years and 298 age-matched controls. RRBs were measured using the Repetitive Behaviour Scale-Revised (RBS-R). The RBS-R restricted interests and rituals/sameness subscales formed the 'higher-order' RRBs composite and the stereotyped and self-injurious behaviour subscales formed the 'lower-order' composite. IQ was measured using the Wechsler Scales and adaptive behaviour using the Vineland Scales. Cognitive inflexibility was assessed as the number of perseverative errors made on a computer-based probabilistic reversal learning (PRL) task (den Ouden et al., 2013). We classified perseverative errors made by ASD individuals using a normative modelling approach, which assessed each ASD participant's performance as the deviation from the age-estimated control group mean. Anxiety was measured using the Beck's Anxiety Inventory.
Results:
As expected, ASD participants scored significantly higher than controls on the RBS-R (p<.001,Â *d*=2.06). Within the ASD group: (1) participants had significantly greater 'higher-order' RRBs than 'lower-order' RRBs (p<.001,Â *d*=0.86; Figure 1); (2) RBS-R total scores significantly decreased with age (r=-.25, p<.001); and (3) RBS-R total scores were significantly negatively related to adaptive behaviour, independent of IQ (r=-.31, p<.001). On the PRL task, the ASD group made significantly more perseverative errors than the control group (p<.001,Â *d*=0.35). However, when stratifying ASD individuals (Figure 2), 62% performed within +/-1SD of the control group mean, and 91% within +/-2SDs. Only 9% performed below 2SDs. No significant relationship was found between perseverative errors and RRBs in the ASD group, nor did the 9% with extremely high perseveration differ in their RRBs profiles. Across age groups, RRBs – and in children notably rituals/sameness behaviours – were significantly related to levels of anxiety in ASD individuals without intellectual disability (all r's>.41,p's<.001).
Conclusions:
We found no evidence for a role of perseveration in RRBs in ASD. Despite significant case-control differences, only a small 'subgroup' of ASD participants demonstrated clinically meaningful (<2SDs) impairments in cognitive inflexibility; and they were unrelated to RRBs. Instead our findings provide proof of concept that anxiety may be a main driver of RRBs, and particularly insistence on sameness. If correct, this suggests an alternative treatment approach in ASD – targeting anxiety to reduce RBBs.

1:57 **148.002** Examining Convergent and Divergent Validity of the Repetitive Behavior Scale for Early Childhood (RBS-EC)

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Background: Recent evidence suggests that aspects of restricted and repetitive behavior (RRB) manifest as early as 12 months of age in high-risk infant siblings subsequently diagnosed with autism, as measured with both direct observation and parent-report (Elison et al., 2014; Wolff et al., 2014). Improved measurement of RRBs could augment early identification.
Objectives: Following the initial psychometric validation of the Repetitive Behavior Scale – Early Childhood (RBS-EC; Wolff, Boyd, & Elison, 2016), we sought to explore the longitudinal continuity and convergent/discriminant validity between the RBS-EC and previously established behavioral measures. We predicted that RBS-EC scores from an initial time point would be positively correlated with the same participants' RBS-EC scores an average of 7.8 month later (range 0.45-13.8 months, *SD*=2.28 months). We predicted that a composite score of all behaviors addressed on the RBS-EC would be associated with dysregulating behaviors (including aspects of sensory sensitivity) as measured by the Infant and Toddler Social Emotional Assessment (ITSEA; Carter et. al., 2003). For discriminant validity, we tested the association of the composite RBS-EC score with the internalizing sub-scale of the ITSEA.
Methods: A community sample of parents of 53 participants (27 male, 26 female) completed the RBS-EC online at a mean age of 22.81 months (range 15.4-26.9 months, *SD*=2.79 months) as part of a larger study. Participants then participated in a follow-up behavioral visit and additional questionnaires again at a mean age of 30.8 months (range 24.6-38.8 months, *SD*=3.22 months). The Mullen Scales of Early Learning was administered to participants, and the Vineland Adaptive Behavior Scales-II was completed with parents. Key metrics from these assessments were used as control variables in the analytic models.
Results: RBS-EC sub-scale scores of repetitive motor, restricted behavior, composite behavior frequency, and interference ratings at the first time point were significantly correlated with scores on the same sub-scales at time of behavioral assessment, (all *r's* > 0.5, and *p's* < 0.001, see Figure 1). This indicates that most RBS-EC sub-scales show continuity across an average of 8 months.
Â After observing a zero order correlation between RBS-EC composite mean frequency at time point 1 and ITSEA Dysregulation at time point 2 (see Figure 2), a hierarchical regression analysis revealed a significant association between these variables when controlling for sex, VABS ABC, Mullen fine motor, and age at time point 2, $F(5, 47)=4.177$, $p=.003$, $\Delta R^2 = 0.149$. This demonstrates that the composite of all items on the RBS-EC has moderate convergent validity with established measures of dysregulation behaviors, and other items capturing ASD traits.
Finally, a hierarchical regression indicated that ITSEA Internalizing scores were not significantly associated with RBS-EC composite scores, ($F(5, 47)=1.287$, $p=.286$, $R^2 change=.007$), controlling for the same variables as above. The lack of association between these scores and RBS-EC's composite score provides preliminary evidence of divergent validity for the RBS-EC.
Conclusions: This study provides preliminary evidence for predictive, convergent, and discriminant validity for the RBS-EC. More work is needed to extend these findings to samples with higher risk individuals and those with current ASD diagnoses.

2:09 **148.003** Characterizing Restricted and Repetitive Behaviors: Exploring the Influence of Age on Rrb Phenotype Clusters

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Background: Restricted and repetitive behaviors (RRBs) are a complex and heterogeneous phenotype of autism spectrum disorders (ASD). Despite being half of the diagnostic criteria dyad, the relationship between specific RRB subdomains and other individual characteristics such as age remains unclear.
Objectives: The purpose of this study was to explore 1) the factor structure of RRB symptoms 2) identify RRB phenotype clusters in a large sample of youth with autism spectrum disorder and 3) determine if phenotypic clusters differ for children as compared to adolescents.
Methods: Participants included 2,757 individuals from Simons Simplex Collection, Simons Ancillary and Simons VIP datasets between the ages of 4 and 18 years old (*M*= 9.2 years*)* diagnosed with ASD. An exploratory factor analysis (EFA) was conducted to determine the factor structure of the Repetitive Behavior Scale-Revised (RBS-R). After visual inspection of RRB subtypes identified by EFA, participants were dichotomized into two groups - participants 4 to 14 years old and participants 14 to 18 years old. A K-means cluster analysis was run on both age groups to determine RRB phenotype clusters and descriptive statistics were calculated for each group.
Results: The EFA resulted in five RRB subdomains, which included hand/body mannerisms (H/B), self-injurious behaviors (SI), compulsivity (C), rigidity (R), and perseverative interests (PI). Results from the cluster analysis indicated that for both age groups there was a cluster of individuals that had elevated scores in *all* RRB domains as well as a group who exhibit reduced frequency across *all* RRB domains. The younger group produced a cluster with elevated compulsivity, rigidity and perseverative behaviors and low levels of self-injury and hand/body mannerisms. Additionally, the remaining cluster endorsed H/B mannerisms the most, with moderate scores of self-injury and perseverative interests, with compulsivity and rigidity having the lowest endorsement. Older participants' mixed clusters exhibited a pattern of more complex RRBs (perseverative interests, rigidity and compulsivity) manifested comparably across clusters, with the lower RRBs (hand/body mannerisms and self-injury) exhibiting a similar pattern.
Conclusions: The present study shows that a simplified representation of RRB presentation would not account for the incredible variability that exists among individuals with ASD. The cluster differences between age groups implies that RRBs do not manifest in the same way across individuals with ASD; which poses complications when the measurement of RRBs is inconsistent across studies. Further, results suggest that the more complex RRB phenotypes (e.g. perseverative interests) may not be as strongly linked in younger children, as they are in 14-18 year olds. These findings have important implications for future research exploring intervention targets for RRBs. It is possible that interventions for RRBs must be domain-specific given the varied RRB subdomain combinations manifested across individuals. Further, researchers should continue exploring the various ways RRBs are manifested across individuals with ASD and across ages to inform appropriate and useful intervention approaches.

2:21 **148.004** Intrainsular Connectivity and Somatosensory Responsiveness in Young Children with ASD

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Background: The human somatosensory system comprises dissociable paths for discriminative and affective touch, reflected in separate peripheral afferent populations and distinct cortical targets. Developmental differences in behavioral and neural responses to affective touch may play an important role in early social experiences, which may be relevant for autism spectrum disorder (ASD). Integrity of two sensory-related white matter pathways may provide insight into developmental differences in affective touch. The thalamocortical tract (sensory thalamus to primary somatosensory cortex) carries discriminative tactile information, while the intrainsular tract (posterior to anterior insula) represents the cortical projection target of unmyelinated tactile afferents mediating affective touch (posterior insula) and integration of sensory and visceral inputs to interpret emotional salience of sensory stimuli (anterior insula). We hypothesized structural integrity in these pathways might mediate variability in behavioral responses to affective touch in young children with ASD.
Objectives: Â To determine structural correlates of behavioral responses to affective sensory stimulation in children with ASD.
Methods: Â Using diffusion tensor imaging and probabilistic tractography, we investigated the structural integrity of the thalamocortical and intrainsular tract by comparing fractional anisotropy, mean diffusivity, and tract volume in a group of young children with ASD (n=29, ages 5-8) and a group of typically developing (TD, n=26) peers. We assessed tactile discrimination and affective response to social touch using the Tactile Defensiveness and Discrimination Test-Revised (TDDT-R). We examined group differences in tract integrity and behavioral assessments (Student's t or Mann-Whitney), as well as relationships between white matter integrity and behavioral responses (Spearman's and linear regression).
Results: Â There were significant group differences in white matter integrity in both tracts investigated, such that individuals with ASD had higher mean diffusivity (MD, lower tract integrity) than individuals in the TD group in both tracts (intrainsular, p=.039; thalamocortical, p=.026). Consistent with previous findings, the ASD group exhibited impairment in tactile discriminative ability and aberrant affective responses (both positive and negative in valence) to touch. Associations between tactile seeking behavior, characterized by positive affective behavioral response and unusually intense interest in tactile stimuli, and intrainsular integrity significantly differed by group (significant group by intrainulsar MD interaction, p=.0032). In the ASD group, increased intrainsular tract integrity was associated with more seeking behaviors while the opposite was true in the TD group. Reduced integrity in thalamocortical tracts was associated with increased tactile defensiveness across both groups.
Conclusions: Individuals with ASD had reduced integrity in both sensory-related tracts, correlating with responses to affective touch, suggesting altered sensory responses may propagate across both discriminative and affective touch pathways in ASD. These results are in line with previous findings that positive affective response to touch is mediated by somatosensory input to the posterior insular cortex (Olausson 2002). Relationships between intrainsular tract integrity and sensory seeking also differed by group, suggesting unique mechanisms may contribute to altered sensory seeking behaviors in ASD.

Oral Session - 7B
149 - Physiological Markers of Sensory Processes Differentiating ASD and Related NDDs
2:40 PM - 3:30 PM - Yerba Buena 7

Session Moderator: Matthew W. Mosconi, *University of Kansas, Lawrence, KS*

2:40 **149.001** Evidence for Domain Specificity of Cortical Auditory and Somatosensory Response Delays in ASD

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Background: Cortical auditory response delays are a well-replicated finding in individuals with Autism Spectrum Disorder (ASD) and have been associated with language deficits. It is unclear, however, whether these delays are specific to auditory processing, are present in other sensory domains, or are associated with generalized cortical latency delays. It is also unclear whether these delays are present in other groups who experience sensory dysfunction but do not meet other symptom criteria for ASD.
Objectives: to determine whether cortical sensory response delays are specific to ASD and whether the latency delays previously reported in ASD are specific to auditory processing.
Methods: Auditory and somatosensory cortical response latencies were compared in 8-12 year-old male participants with ASD (N=18), those with sensory processing dysfunction (SPD) who do not meet criteria for ASD (N=13), and in typically developing control (TDC) participants (N=19). Auditory and somatosensory latencies were measured via MEG evoked responses to standard stimuli presented in two passive mismatch negativity tasks (i.e., response to a 1000Hz tone for the auditory evoked response and application of a tap to the left middle fingertip for the somatosensory evoked task). Measures of communication (i.e., phonemic processing, language pragmatics, and verbal intellectual abilities) were administered to examine associations between auditory processing delays and language deficits associated with ASD.
Results: ANCOVAs were performed (age as covariate) to determine if groups differed in M100 or M200 auditory response latency in each hemisphere, or contralateral somatosensory response. Significant group differences were identified for the left auditory M200 latency, $F(2,45)=3.61$, $p=.035$, and right somatosensory latency $F(2,46)=3.63$, $p=.035$. Specifically, the ASD left M200 latency was significantly delayed relative to both the TDC and SPD groups, whereas the somatosensory response in the ASD group was only delayed relative to the TDC group and did not significantly differ from the SPD group, who presented with an intermediate somatosensory latency. Likewise, response latencies for the M100 response followed a similar pattern to the M200, with the clinical groups showing longer mean latencies bilaterally, although group differences were not statistically significant. A hierarchical regression analysis performed with nonverbal intelligence entered in Step 1, language variables entered in Step 2, and left M200 latency as the dependent variable demonstrated that language abilities accounted for 60.3% of the variance in left M200 latency after controlling for the effects of nonverbal intelligence (which accounted for 5.7% of the variance) in the ASD group, with $F(3,10)=5.91$, $p=.014$. These associations were not significant in the SPD or TDC groups. Finally, the cortical auditory M200 response latency delays detected in the ASD group were not significantly associated with delayed somatosensory latencies ($r=.172$, $p=.494$).
Conclusions: These results provide evidence of auditory and somatosensory response delays in ASD, and support prior findings demonstrating associations between delayed auditory latencies and language abilities. Further, while these cortical sensory responses were delayed in ASD compared to SPD and TDC groups, the weak association between these delays across sensory domains suggests that these deficits are domain specific rather than reflective of generalized cortical processing delays in ASD.

2:52 **149.002** Neuromagnetic Responses to Tactile Stimulation of the Fingers: Evidence for Reduced Cortical Inhibition for Children with Autism and Children with Epilepsy

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Background: Â Magnetoencephalographic (MEG) measurements of somatosensory evoked responses to tactile stimulation of the digits result in an early cortical response labelled the '$_T$P30m' and a '$_T$P50m' which occurs at approximately 50ms following the presentation of a transient mechanical stimulus (e.g., a finger tap). Several lines of evidence support the position that the $_T$P50m response is associated with GABA dependent post-excitatory inhibition. Moreover, GABA signaling is thought to be downregulated in both children with autism (ASD) and children with epilepsy (EPI).
Objectives: Â Our objective was to compare $_T$P50m responses from a group of 15 children with ASD (mean age 9.95 ±1.23 SD years; 3 female), and a separate group of 17 children with EPI (mean age 10.57 ±1.72 SD years; 4 female) with $_T$P50m responses recorded from a group of 15 age matched typically developing (TD) controls (mean age 10.21±1.61 SD years; 2 female). We hypothesized that separately, for children with EPI and children with ASD, we would observe decreased SEF$_T$P50m response amplitudes to tactile stimulation of the digits.
Methods: Â MEG recordings were performed at the Lurie Family Foundations' MEG Imaging Center of the Department of Radiology at the Children's Hospital of Philadelphia in a magnetically shielded room using a whole-cortex 275-channel MEG system. Somatosensory stimuli were presented to the left and right index fingers sequentially using pneumatic pulses of compressed air (30 p.s.i.) delivered via clip-on balloon diaphragms. Stimulation duration was 40ms and jittered between 0.5 and 0.7s random ISI. Data were collected in epochs of -0.1 to 0.3s for a total of 500 trials. Source localization of the $_T$P50m response yielded a $_T$P50m response strength parameter (i.e. equivalent current dipole (ECD) moment) as well as a peak latency which we considered in our linear mixed model using subject as a random effect, group and hemisphere as fixed effects, and age as a covariate.
Results: We observed a significant overall group effect of reduced $_T$P50m dipole moment $F(2,41)=3.99$, $P<0.05$. Independent post-hoc pair wise comparisons for dipole moment showed marginal means were significantly different comparing TD (21.3±1.8nAm) vs. ASD (15.4±1.9nAm), P=0.027 as well as TD vs. EPI (14.9±1.7nAm), P=0.014. In addition, we observed a significant overall group effect for $_T$P50m peak latency $F(2,41)=4.66$, $P<0.05$. Post-hoc pair wise comparisons for dipole latency showed this to be driven by a latency delay of ~8ms in the EPI group: marginal means were significantly different comparing TD (50±2ms) and EPI (58ms±2ms), P=0.014, and not significant for TD vs. ASD (50±2ms), P=0.9.
Conclusions: We observed significant decreases in $_T$P50m dipole moment values from the ECD source localized $_T$P50m response, for children with EPI and children with ASD. In addition, the latency of the $_T$P50m peak was observed to be equivalent between TD and ASD groups but was significantly delayed in children with EPI by approximately 8 ms. The failure to observe a latency difference in TD vs ASD is interesting in relation to the well-established finding of delayed auditory responses known to occur in children with ASD and will be the subject of future investigation.

3:04 **149.003** Can Parent Report and Direct Assessment Measures Enhance Sensory over-Responsivity Phenotyping and Inform the Neural Underpinnings of Sensory Processing Symptoms?

E. Marco[1], *A. Brandes-aitken*[2], *T. Tavassoli*[3], *L. J. Miller*[4], *S. A. Schoen*[5], *J. Owen*[6] *and P. Mukherjee*[7], *(1)University of California, San Francisco, Larkspur, CA, (2)University of California, San Francsico, San Francisco, CA, (3)Seaver Autism Center, New York, NY, (4)STAR Institute for SPD, Greenwood Village, CO, (5)Sensory Processing Disorder Foundation, Greenwood, CO, (6)Neurology, UCSF, San Francisco, CA, (7)University of California, San Francisco, San Francisco, CA*

Background: There is mounting evidence to suggest that sensory over-responsivity is common across children with neurodevelopmental disorders, including children with autism spectrum disorders (ASD) and sensory processing dysfunction (SPD). However, the standard methodology of determining these differences is with parent report questionnaires. There is no consensus on how to reliably measure sensory over-responsivity with a direct assessment tool by sensory domain. Reliable tools, both parent report and direct assessment, for determining the presence and nature of specific sensory dysfunction, such as over-responsivity, is a critical step for researchers and clinicians alike as we seek to understand the biologic underpinnings of sensory processing.
Objectives: This study has two main objectives, first to define a scoring methodology specific to tactile and auditory over-responsivity based on the Short Sensory Profile (SSP), a parent report questionnaire, and the Sensory Processing Scale Assessment (SPS-A), direct observation session, and then to analyze the inter-test agreement between these assessments. Second, using MRI Diffusion Tensor Imaging (DTI), we seek to determine whether children with auditory or tactile over-responsivity show uniquely decreased regions of white matter integrity.
Methods: Using a Research Domain Criteria (RDoC) approach this study included children with auditory and tactile over-responsivity from a mixed neurodevelopmental cohort (NDC), including children with ASD and SPD and children with no known neuro-sensory challenges. For our first aim, a large sample of typically developing children (TDC) children (n=128) was collected to establish cut-off scores for over-responsivity. Then all children (TDC, n=128 and NDC, n=21) were categorized as over-responsive in either the auditory or tactile domain if they deviated significantly from the expected mean. For the neuroimaging analysis, 39 children with both brain imaging and direct sensory assessment were included and grouped by sensory over-responsivity (yes/no) in either the auditory or tactile domain. Sensory-based group comparisons were then conducted comparing the white matter fractional anisotropy (FA) in 23 regions of interest (ROIs).
Results: Cut-off scores for auditory and tactile over-responsivity were established. Using the direct observation, 57% of the NDC children had auditory over-responsivity and 33% had tactile over-responsivity. The Inter-test-agreement between SSP and SPS-A for auditory over-responsivity was 65% and tactile over-responsivity was 50%. Using neuroimaging DTI analysis, we found that children with auditory and tactile over-responsivity by direct assessment had 19 total tracts showing decreased white matter integrity relative to children without either auditory or tactile over-responsivity. Of these atypical tracts, 15 were uniquely associated with auditory over-responsivity and 2 were uniquely associated with tactile over-responsivity.
Conclusions: This study identified cut scores for auditory and tactile over-responsivity using the SSP parent report measure and SPS-A direct observation. This direct observation measure can be used in clinical and research settings. The SSP parent report and SPS-A direct observation ratings overlapped moderately for sensory related behaviors. Furthermore, based on our preliminary DTI results, we suggest that non-overlapping white matter tracts may contribute to the disruption of auditory or tactile processing leading to a domain specific over-responsive phenotype.

3:16 **149.004** Visuomotor Integration: A Potential Biomarker of Autism Spectrum Disorder in Lab and Community-Based Settings

H. L. Miller[1], *P. Caçola*[2], *G. Sherrod*[1] *and N. Bugnariu*[1], *(1)University of North Texas Health Science Center, Fort Worth, TX, (2)University of Texas at Arlington, Arlington, TX*

Background:
In recent years, sensorimotor features of Autism Spectrum Disorder (ASD) have garnered increased attention. However, few studies have investigated how sensory and motor systems work in coordination, or how they differ between typical and atypical development and within various developmental disorders. To that end, we quantitatively assessed *visuomotor integration*–the use of visual information to guide motor behavior–and its influence on postural stability in two studies of individuals with ASD, typical development (TD), and Developmental Coordination Disorder (DCD). The first study took place in our virtual reality lab, and the second study took place at community, school, and clinical sites.
Objectives:
To define the relationship between postural control, eye movement, and visual context in ASD, and to determine whether this relationship varies between ASD, TD, and DCD.
Methods:
Study 1: 30 participants (10 ASD, 10 DCD, 10 TD) completed a variety of visuomotor integration tasks while wearing mobile eye-tracking glasses and standing on force plates in a full-body motion capture and immersive virtual reality system (Figure 1). These tasks required a range of behavioral responding, from "watch-only" conditions to "watch-and-move" conditions where participants engaged with the virtual environment via user-controlled objects.
Study 2: 50 participants (20 ASD, 10 DCD, 20 TD) completed a brief set of two visuomotor integration tasks while wearing mobile eye-tracking glasses and standing on a portable force platform. The first task tested postural control during quiet standing with vision unoccluded, occluded, and partially occluded. The second task tested postural control during a limits-of-stability task that required leaning to move a user-controlled object to static targets displayed on a screen. This community-based study used portable, low-cost equipment and rapid data collection (< 15 min per participant).
Results:
Across both studies, the ASD group had appreciable differences in quantitative measures of postural stability compared to the TD and DCD groups (Figure 2). These differences were particularly evident in tasks when visual context was unavailable or when the task required the use of information about visual motion (i.e., targets moving rather than static) to produce accurate responses. Eye movement differences were also evident, with the ASD group demonstrating difficulty maintaining visual pursuit of moving targets and a reduced ability to fixate static targets relative to DCD and TD groups.
Conclusions:
These data suggest that quantitative assessments of visuomotor integration may be a promising avenue of investigation as a biomarker to differentiate ASD from TD and other developmental disorders with shared motor features, like DCD. They also highlight the important role of visual information processing in the ability of individuals with ASD to maintain balance and to control intentional movements. While results from Study 1 provide a more detailed assessment of visuomotor integration in ASD, Study 2 demonstrates the feasibility of transferring these types of tasks and outcome measures to community settings including schools and clinics. A brief visuomotor screening of this nature may aid in identifying sensorimotor issues in individuals with ASD who have not received comprehensive evaluation, and may also facilitate individualized interventions tailored to meet specific sensorimotor needs.

Oral Session - 8A
150 - Perception, Memory, Language, and Decision Making
1:45 PM - 2:35 PM - Yerba Buena 8

Session Moderator: Natalie Russo, *Syracuse University, Syracuse, NY*

1:45 **150.001** The Influence of Prior Knowledge on Immediate Memory for Objects in ASD

***S. Pisani**, M. Poirier, D. M. Bowler and S. B. Gaigg, Psychology, City, University of London, London, United Kingdom*

Background: Recent evidence suggests that the perceptual experiences of individuals with ASD are modulated atypically by stored representations (*priors*), leading to a more accurate perception of incoming sensory information and less distortion by prior experience (e.g., Pellicano & Burr, 2012). It remains unclear, however, to what extent this difference in perception is a result of abnormalities in how experiences initially shape and update representations or in how representations are activated by sensory information. In the mainstream literature, Hemmer & Steyvers (2009) have developed an experimental paradigm that can shed some light on this issue. They showed that memory for the size of recently presented familiar stimuli (fruit, vegetables) is not only biased by the statistical properties of the stimuli presented during the experiment but also by the prior knowledge about the size of items that participants bring to the experiment.
Objectives: To shed further light on the interaction between prior knowledge and recent perceptual experience in ASD through the application of an adapted version of Hemmer & Steyvers' (2009) paradigm.
Methods: 17 ASD and 19 age and IQ matched typically developing (TD) adults participated in two experiments. Experiment 1 probed participant's long-term representations of the sizes of fruits by presenting photographs of these on a PC monitor and asking participants to resize them to what they considered to be the smallest possible, largest possible and average size of each item. Abnormalities in how prior knowledge is represented in long-term memory in ASD should lead to differences in the range and/or means of these sizes relative to controls. In experiment 2, 3 items were sequentially presented that could either be vegetables or control abstract shapes yoked in size to the vegetables. Participants were asked to remember the size of each item. Following each set, one item was re-presented in a new random size that participants needed to resize to the studied size. Importantly, the vegetable images included items that were either relatively small or large relative to their respective category mean (e.g., a small vs large radish). This design allows inferences to be drawn on how super-ordinate category and item-level representations of objects influence performance and comparison with the resizing of abstract shapes sheds light on how biases due to prior knowledge deviate from biases that develop during the course of the experiment.
Results: Experiment 1 revealed a tendency for ASD participants to report a greater range of sizes than TD participants, supporting the notion that prior knowledge may be represented atypically in ASD. In Experiment 2, participants with ASD were less accurate overall in re-constructing the sizes of to-be-remembered vegetables and shapes but both groups demonstrated similar levels of regression to the mean and biases that were induced by prior knowledge.
Conclusions: The results suggest that in ASD, the representations of recently viewed objects is slightly noisier or imprecise (Exp 2) and that this may lead to atypical representations of object properties in longer-term memory (Exp 1). The processes by which prior knowledge bias behaviour, however seem to operate typically.

1:57 **150.002** Decision-Making Under Ambiguity and Risk in Adolescents and Young Adults with Autism Spectrum Disorder

***M. K. Krug**, C. C. Coleman, G. C. Gower and M. Solomon, Department of Psychiatry & Behavioral Sciences, University of California-Davis, Sacramento, CA*

Background:
Little is known about decision-making in autism spectrum disorder (ASD), despite its potential impact on functioning. Decision-making under ambiguity can be investigated using the Iowa Gambling Task (IGT), where learning is implicit. Studies have shown impaired performance on the IGT in ASD (Mussey et al., 2015; Zhang et al., 2015), although South et al. (2014) observed enhanced performance. A modified version of the IGT (mIGT), which eliminates the potential confound of differences in exploratory behavior, and allows for separation of approach (choosing to "play" a good deck) and avoidance (choosing to "pass" on a bad deck) behavior, has been developed but has not yet been used in ASD (Cauffman et al., 2010). Decision-making under risk can be assessed using the Game of Dice Task (GDT), where outcomes are unambiguous and explicit. Zhang et al. (2015) found impaired performance and suboptimal use of trial feedback in ASD.
Â Objectives:
1. Continue to investigate decision-making under risk using the GDT. 2. Examine decision-making under ambiguity using the new mIGT. 3. Explore how performance on decision-making tasks is related to cognitive functioning and psychopathology.
Methods:
22 ASD (Age = 16.45(2.67); FSIQ = 101.27(15.11)) and 29 TYP participants (Age = 16.07(2.91); FSIQ = 110.03(12.79)) performed the GDT and mIGT. In the GDT a bet is placed on 1, 2, 3 or 4 sides of the die. A selection of 1 or 2 sides is considered "risky," while selection of 3 or 4 sides is considered "safe." For each mIGT trial one of four decks is pre-selected and can be "played" or "passed." Cognition was assessed using the NIH Toolbox Cognition Battery (www.nihtoolbox.org). Psychopathology was assessed with the Achenbach System of Empirically Based Assessment (ASEBA) (Achenbach & Rescorla, 2001; 2003).
Results:
GDT: Mean net score (#safe choices – #risky choices) was significantly higher for TYP (12.59(6.67)) versus ASD (7.27(8.56)), F (1,48) = 4.820, p = .033. TYP was more likely to place a safe bet following a "safe" win trial (F (1,48) = 5.275, p = .026) and after a "risky" loss trial (F (1,36) = 3.688, p = .063, trend) compared to ASD (Figure 1a), indicating better use of feedback.
Â mIGT: For TYP, the difference in %played between good decks and bad decks was significant for Blocks 3, 5, and 6 (all ps <.05). A comparison of Block 1 and Block 6 indicated that TYP, but not ASD, participants learned to avoid bad decks (t(28) = 2.709, p = .011) (Figure 1b).
TYP performance on IGT was positively correlated with NIH Toolbox Cognitive Function Composite Score (Figure 2a). In ASD, there was an association between anxiety and obsessive compulsive symptoms and poorer IGT performance (Figure 2b, c).
Conclusions:
Participants with ASD show impairments in decision making under risk (GDT) and ambiguity (mIGT). Decision making is related to cognitive functioning in TYP and anxiety and compulsive symptoms in ASD.Â Data collection is ongoing, and age groups effects analyses will assess development of decision-making processes throughout adolescence and young adulthood and their relationship to adaptive functioning.

2:09 **150.003** Imitation, Joint Attention and Language Development in Autism Spectrum Disorder

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Background: Previous research indicates that early joint attention and imitation skills predict structural language development in children with ASD. Pragmatic impairments are universal in ASD; however, little research has examined contributions of joint attention and imitation to pragmatic communication versus structural language. In one study, imitation skills (assessed by parent-reported McArthur Communicative Development Inventory, M-CDI) predicted pragmatic growth in 34 children with ASD from aged 41 months to 54 months, whereas core language (also M-CDI) did not significantly predict pragmatics (Miniscalco et al., 2014). Research over a wider developmental range with specific, direct measures of imitation, joint attention, pragmatics, and structural language is required to test these associations.
Objectives: To investigate predictive contributions of early imitation and joint attention skills to structural language and pragmatic communication skills in a large longitudinal sample of children with ASD.
Methods: Data were analyzed from 421 children in the *Pathways in ASD* study at 3 points; Time 1 (within 4 months of diagnosis, mean age 39.8 mo), Time 2 (mean age 69.3 mo) and Time 3 (mean age 98.4 mo). At T1, children participated in tests of elicited imitation (Multidimensional Imitation Assessment, MIA), and joint attention (Early Social Communication Scales, response to joint attention; ESCS RJA). At T2, cognitive ability (Wechsler Preschool and Primary Scale of Intelligence, Fourth Edition, WPPSI-IV), structural language (Preschool Language Scale – 4, PLS-4) and pragmatic communication (Children's Communication Checklist – 2 Social Interaction Deviance Composite, CCC-2 SIDC) were assessed. At T3, children completed the T2 measures and an additional test of pragmatic communication via narratives, the Expression, Reception and Recall of Narrative Instrument (ERRNI).
The ERRNI Initial Ideas score variable revealed a zero-inflated distribution, so zero-inflated negative binomial regression was implemented. In the present study, the assessment of narrative skills requires a level of language ability that some children with ASD will not acquire (resulting in scores of 0 on narrative). Dependent variables with distributions approximating normality (CCC-2 SIDC, PLS-4 Total Language) were analyzed using multiple regression. All analyses were adjusted to control for non-verbal intelligence quotient (NVIQ).
Results: Decreased imitation at T1 was associated with pragmatic skill deficits at T2 (p=0.008), independent of structural language. T1 RJA was specifically associated with pragmatic discourse skills at T3 (p=0.041). T1 imitation and RJA were not significantly predictive of T2 structural language after controlling for NVIQ.
Conclusions: Although these results are inconsistent with evidence that both elicited imitation and joint attention strongly predict structural language (e.g., Stone & Yoder, 2001), many previous studies examined briefer developmental periods and did not consistently control for nonverbal intelligence. In this study, preschoolers' imitation and RJA skills were associated with later development of distinct pragmatic skills. These results from a large, well characterized sample of children with ASD add to the literature on predictive roles of early social communicative behavior to later language and pragmatic communication. Additional clarification is needed of the mechanisms underlying the development of structural versus pragmatic language.

2:21 **150.004** Enhanced Perceptual Capacity in the Classroom: Harnessing Cognitive Strengths to Promote Learning

S. O'Brien[1]*, M. Hanley*[2]*, D. M. Riby*[2]*, J. Swettenham*[3] *and* ***A. Remington***[1]*, (1)Centre for Research in Autism and Education (CRAE), UCL Institute of Education, University College London, London, United Kingdom, (2)Department of Psychology, Durham University, Durham, United Kingdom, (3)University College London, London, UNITED KINGDOM*

Background:
Research has demonstrated evidence for increased perceptual capacity in autism: autistic children and adults can process more information at any given time than neurotypical individuals. In tasks with high perceptual load (large amount of task-relevant information), this additional capacity is beneficial, leading to superior performance. When perceptual load is low, however, spare capacity processes task-irrelevant information, leading to increased distractibility. In this way, increased perceptual capacity can account for both superiorities and deficits seen in the condition. Reframing autistic attentional behaviour in terms of increased capacity rather than a filtering deficit has implications for autism interventions, yet these have not been investigated.
Objectives:
This study aimed to explore the implications of increased capacity in educational settings. Currently, classrooms for autistic children tend to have minimal stimuli on the walls and tasks are often simplified. Our somewhat counterintuitive prediction is that increasing the amount of relevant information in an educational task would *improve* learning outcomes: the extra perceptual capacity could be used by the child for task-relevant processing rather than irrelevant distractions. The proposed project aimed to test this, investigating whether the higher perceptual capacity of autistic children can be indeed be capitalised on to improve learning in the classroom.
Methods:
73 children (6-14 years, 23 autistic, 50 neurotypical, matched on age and non-verbal IQ) performed a 'real-world' attention task. Participants watched a five-minute video of a teacher talking about an Irish myth or legend and were asked to remember as much as they could. The background behind the teacher which was either a) blank b) filled with relevant pictures (related to story being told) or c) filled with irrelevant pictures (e.g. solar system poster, number charts). At the end of the video, children were asked questions about aspects of the story, but also – unexpectedly - about items in the background. Each child watched three videos: one from each condition.
Results:
For *both* groups, learning outcomes (e.g. amount recalled from verbal story) were better in the high load, task-relevant background condition than when there was no background information ($p < .001$). Like their typical peers, autistic children benefitted from the additional information; in this case, simplifying the task hindered learning rather than facilitated it.
In accordance with increased perceptual capacity, we also found that autistic children processed more irrelevant background information than neurotypical children: scoring significantly higher when asked about the background images ($p = .039$). Given that the level of story learning was equivalent between the two groups, we conclude that irrelevant background items were processed as well as central task items, not instead of them.
Conclusions:
Our findings suggest that, at least in some situations, increasing the amount of task-relevant information of an educational task improves learning outcomes for autistic children. We hope this is the starting point of a line of applied research based on the idea of increased perceptual capacity in autism, which may inform the creation of new learning interventions for children on the spectrum, and have a significant impact on their educational success.

Oral Session - 8B
151 - Autism and Early Language Development
2:40 PM - 3:30 PM - Yerba Buena 8

Session Moderator: Dermot M. Bowler, *Psychology, City, University of London, London, United Kingdom*

2:40 **151.001** Language Development in High-Familial Risk Infants Who Go on to Have Autism or Language Delay

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Background: Infant-sibling studies have indicated that infants who develop ASD exhibit emerging delays in language skills around 12 months that become more pronounced by 24 months. Toddlers with ASD tend to show balanced receptive/expressive profiles, whereas typically developing toddlers show a receptive language advantage (i.e., higher receptive than expressive scores; Hudry et al, 2014). However, language outcomes for unaffected siblings have been inconsistent (Landa et al., 2006; Charman et al., 2016). It is not clear if unaffected siblings show language delay and a receptive language advantage.
Objectives: This study included two main objectives: (1) to compare the language development of two groups of high-risk infants, those who go on to have ASD and those without ASD who demonstrate language delay, and (2) to determine if infants with ASD or language delay display normative patterns of receptive advantage.
Methods: Infants at high and low familial risk for ASD were assessed longitudinally at ages 6, 12, and 24 months. Inclusion criteria included the completion of least two assessments and diagnostic outcome at 24-months (N=525).
At each visit, infants were assessed using the Mullen Scales of Early Learning (MSEL). Verbal developmental quotients (VDQ) were calculated from receptive and expressive subscales. Receptive advantage scores were generated by computing receptive-expressive difference scores (Hudry et al., 2014). Positive values indicate higher receptive than expressive language scores.
Eighty-six infants met clinical best-estimate criteria for ASD (HR-ASD, 77% male) at age 24 months. The remaining high-risk infants without ASD were then classified by language delay. Criteria for LD was a t-score <35 on either the MSEL receptive or expressive language subscale (>1.5 SD below population mean), in accordance with standard measures (Northrup & Iverson, 2015). Of these high-risk infants, 41 met criteria for language delay (HR-LD, 65% male) and 255 did not meet criteria for either ASD or LD (HR-neg, 54% male). An additional 143 low-risk control infants (LR-neg, 58% male) did not meet criteria for ASD or language delay. Dependent variables included VDQ, MSEL expressive and receptive t-scores, and receptive advantage score. All models included the effects of group, time, group*time, and were covaried for sex, NVDQ, and maternal education.
Results: Longitudinal mixed models indicated that trajectories of language development differed across groups for VDQ, t-scores, and receptive advantage ($p<.005$). Follow-up cross-sectional analyses indicated that groups did not differ in VDQ at 6-months, however at 12 and 24-months group differences were evident, with HR-ASD and HR-LD < HR-neg < LR-neg (Table 1). Receptive advantage scores did not differ by groups at 6- or 12-months; however, at 24-months the HR-ASD group displayed lower receptive advantage scores than all other groups.
Conclusions: Our results indicate that high-risk toddlers who have ASD and toddlers who display language delay both show lower language scores at 12-months when compared to peers. Interestingly, toddlers with language delay displayed the expected receptive advantage profile at 24-months, whereas toddlers with ASD displayed a more balanced profile. These receptive advantage results may reflect an aberrant process specific to ASD that becomes apparent in the second year of life.

2:52 **151.002** Minimally Verbal Two-Year-Olds with ASD Succeed in Using Linguistic Information to Generate Expectations about the Visual World

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Background: Much of what is learned about the world occurs outside of the visual field. A unique and important aspect of human cognition is the ability to gather knowledge through language. Previous work with typically-developing (TD) toddlers suggests that the ability to use verbal information to make and update expectations about the visual world emerges by 16 months (Ganea et al., 2016). It is unknown how the development of this skill might differ for very young children with autism spectrum disorder (ASD), who often display weak receptive & expressive communication skills.
Objectives: Â The goal of this study was to examine the abilities of toddlers with ASD to form expectations based on verbal versus visual information.
Methods: Â Participants were 19 toddlers with ASD (18-36 months, *M* = 28.2 months) and 26 TD toddlers (15-22 months, *M*= 18.6 months). ASD diagnoses were confirmed with the ADOS-2 and a licensed psychologist's clinical impression. Using an eyetracker, we presented toddlers with a scene of a cat and dog. The scene was then occluded, and one of the animals (e.g. the cat) changed location. Toddlers either saw the cat passing between occluded locations (visual condition), or heard a description of it (verbal condition). We next revealed either a congruent outcome (the cat in the new location), or an incongruent outcome (the dog instead). Toddlers participated in both visual and verbal conditions, as well as congruent and incongruent trials (order was counterbalanced for congruency and condition). Looking time and number of fixations to the outcome were compared across congruency, condition (visual vs. verbal), and diagnostic group. Toddlers were assessed on the Mullen Scales of Early Learning (MSEL); the groups were not significantly different on nonverbal scales (visual reception and fine motor).
Results: There was a main effect of congruency on looking time ($F(1, 43) = 4.25$, $p = .04$, $\eta_p^2 = .09$), and number of fixations ($F(1, 43) = 5.865$, $p = .02$, $\eta_p^2 = .12$). Both measures were significantly higher in the incongruent than the congruent outcome across both groups and conditions. There was no main effect of condition, and no interactions, suggesting no verbal deficit for the ASD group ($\eta_p^2 < .005$) There was a main effect of diagnosis on looking time ($F(1, 43) = 8.94$, $p < .001$, $\eta_p^2 = .17$); TD participants looked longer overall. This effect was not present in the fixation count analysis, that is, participants with ASD accomplished the same amount of scene exploration in less time. The success of toddlers with ASD in the verbal condition is even more impressive as they had significantly lower receptive language scores on the MSEL than TD controls, ($p<.001$).
Conclusions: Both groups of toddlers looked longer and performed more exploration of incongruent outcomes, suggesting that they could use both visual and verbal information gathered during occlusion to generate expectations about the outcome. In other words, despite their weaker receptive language skills, 2-year-old toddlers with ASD showed no impairments in forming expectations based on linguistic information in our paradigm.

3:04 **151.003** Weak Organization of Semantic Categories in Young Children with ASD

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Background:
Young children with ASD show striking delays in vocabulary development, but we are only beginning to understand why this is the case. One under-explored possibility is that these children have trouble organizing early-learned words into semantic categories (e.g., clothing items, food, animals). Failing to categorize words based on semantic similarities could disrupt lexical retrieval, thereby contributing to the language delays experienced by so many young children with ASD.
Objectives:
Our objective was to determine whether young children with ASD organize semantic categories differently than typically developing (TD) children. To accomplish this objective, we designed an eye-gaze task using the looking-while-listening paradigm to measure the extent to which children looked at objects that were semantically related to a spoken label, when the labeled object itself was not visible (i.e., whether children looked at a sock—instead of an apple—upon hearing, *Where's the hat?*). We predicted that children with ASD would look less at semantically-related objects than typically developing children, indicating weaker organization of semantic categories.
Methods:
Participants were 24 TD children and 25 children with ASD. All children in the ASD group received a DSM-5 diagnosis of ASD as part of the research visit, based on the ADI-R, ADOS-2, and expert clinical judgment. Groups were matched on Auditory Comprehension growth scale values from the Preschool Language Scale, 5th Edition (p = .13). On average, TD children were 20 months old (SD = 1) and children with ASD were 32 months old (SD = 3).
For the eye-gaze task, children sat on their parent's lap in front of a large television screen. In Target Present trials, children viewed two images (e.g., apple, hat) and heard one named (e.g., *Where's the hat?*). In Target Absent trials, children viewed two images (e.g., apple, sock) and heard a label that was semantically related to one image (e.g., *Where's the hat*?). Eye movements were coded offline.
Results:
Gaze from 300 to 1700 ms after noun onset was modeled using growth curve analysis. Time was the independent variable and log odds of looking to target was the dependent variable. The model of each group included linear, quadratic, and cubic orthogonal time terms and allowed for participant and participant x condition random effects.
Not surprisingly, children in both groups looked less at the 'target' (i.e., semantically-related object) in Target Absent trials (ps < .001). However, the discrepancy between the Target Present and Target Absent conditions was more pronounced in the ASD group than in the TD group (see Figure), as indicated by a shallower linear slope in the Target Absent conditionÂ the Target Present condition in the ASD group alone (p = .002).
Conclusions:
These findings suggest that children with ASD have weaker semantic organization for early-learned words than TD children, which could contribute to the difficulties they experience learning language. Importantly, this was the case even though children in both groups recognized the words when the objects were correctly labeled. Learning semantic categories may be an important intervention goal for young children with ASD.

3:16 **151.004** How Beginning to Speak Alters Early Parent-Child Interactions in Autism

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Background: Â The language development of young children with autism spectrum disorder (ASD) is quite unpredictable. Although onset is almost always delayed, outcome is remarkably heterogeneous. This heterogeneity is likely rooted in infancy when ASD-related joint attention deficits affect the child's access to language during parent-child interactions. Studies indicate that early joint engagement predicts language outcome. However, the evidence base is still too narrow to document how joint attention deficits hamper word learning as well as how partners might compensate for a child's difficulties.
Objectives: Â Our aims were 1) to broaden the view of joint engagement during interactions to characterize the partner's supportive role and the overall dynamics of the dyadic exchange as well as the child's joint engagement, and 2) to discern if beginning to speak transforms interactions.
Methods: Â 144 toddlers participated: 58 with ASD, 46 with non-ASD developmental delay (DD), and 40 typically developing (TD). Two 30 min parent-child interactions were video recorded, first at an *initial visit* that occurred before diagnosis (mean age = 24.4 m) and, for 46 in the ASD and 32 in the DD groups, in a *follow-up visit* approximately a half-year later (M age = 31.6 m).Â Reliable ratings were made using the 8 items from the Joint Engagement Rating Inventory (JERI) for child's joint engagement, affective communication, parent's scaffolding and following in of child's interests, and the interaction's fluency and connectedness.Â Children were classified as not speaking or speaking during the interaction at each visit.
Results: Â During the *initial visit*, all rating-item means were significantly lower for the ASD than for the DD and TD groups and all diagnostic group effects were significant with a median effect size of .34 (range = .24–.42; see Table 1). Moreover, all rating-item means were significantly lower for the not-speaking than for the speaking group (median effect size =.26, range = .18–.57) across both the ASD and DD groups. To determine whether beginning to speak altered interactions, we categorized those children with ASD and DD who completed the *follow-up visit* as:Â (a) remained not speaking, (b) became speakers, and (c) remained speakers. Changes in the rating items from initial to follow-up visits were most marked for children who became speakers.Â Notably, compared to children who remained not speaking, significant changes occurred in parent's scaffolding and the interaction's fluency and connectedness as well as in child's joint engagement and affective communication (see Table 2).
Conclusions: Â Our findings indicate that early parent-child interactions are negatively impacted by ASD even before early diagnosis, especially when the child is not speaking. However, if the child begins to speak, several aspects of interactions change significantly. This finding complements the claim that joint attention plays a pivotal role in early word learning by demonstrating the impact of language use on parent-toddler interactions. This work highlights the importance of transactional processes between social interactions and language use both for theories of early developmental processes in ASD and for early interventions.

Oral Session - 9A
152 - Early Developmental Profiles
1:45 PM - 2:35 PM - Yerba Buena 9

Session Moderator: Lonnie Zwaigenbaum, *University of Alberta, Edmonton, AB, CANADA*

1:45 **152.001** Comparison of Social Motivation and Sticky Attention Models of Early Development in ASD

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Background: Two models propose alternative theories related to the early development of ASD. Social Motivation theory posits that infants later diagnosed with ASD are less motivated by social information which creates reduced opportunities for social learning (e.g., Chevallier et al., 2012). In contrast, Attention theory suggests that infants and children with ASD have an atypical development of attention (e.g., "sticky attention") that interferes with later social communication development (Landry & Bryson, 2004; Sacrey et al., 2014).
Objectives: This study compared these two developmental models, Social Motivation and Attention theories, in a community-based sample of infants who screened positive on an autism screening inventory and were followed into early childhood.
Methods: Participants included 43 children identified at high-risk for a later diagnosis of ASD based on the First Year Inventory (FYI) community screening at 12 months of age. Toddlers were evaluated at 13 (Time 1) and 22 months (Time 2). A third evaluation was conducted during early childhood (age 3-5 years) to determine diagnostic outcome using the Autism Diagnostic Observation Scale, parent interview, and clinical judgment. Thirteen children were diagnosed with ASD and 30 children did not meet criteria for ASD at Time 3.
Video coding for social motivation (looking at people) and "sticky" attention (shifting of attention and RRBs) was completed using the Communication and Symbolic Behavior Scales (CSBS) at 13 and 22 months. Social motivation was defined as the proportion of time the child spent clearly looking at a person. An attention shift was identified when children disengaged their attention from a stimulus, shifted their gaze, *and* immediately re-engaged their attention with another stimulus. RRBs were measured using the CSBS RSM scale (Wetherby & Morgan, 2007). Group means are displayed in Table 1.
Results: Path analyses were conducted to evaluate the direct and indirect effects of measures of looking at people, attention shifting, and RRBs at Time 1 and 2 on ASD symptom severity as measured by the ADOS-2 comparison score after controlling for cognitive abilities at Time 1. Direct effects are shown in Figure 1. Results indicated a significant indirect effect from decreased looking at people at Time 1 to decreased attention shifting at Time 2 to increased ASD symptom severity during early childhood (β=-.36, *p*=.02). Further analyses indicated that this indirect effect remained when only examining social-specific shifting (i.e., attention shifting including a person) but was not present when only including non-social shifting (i.e., shifting attention between objects).
Conclusions: Using this longitudinal sample provides an opportunity to disentangle the role of social motivation and attention shifting. Results from this study better support the Social Motivation theory of ASD. Looking at people at 13 months predicted ASD symptoms during early childhood as mediated by attention shifting at 22 months. While impairments in attention clearly play an integral role in later diagnosis of ASD, attention shifting that included social information appears to play a larger role than attention shifting to non-social information. Future studies can examine trajectories starting earlier in development to better evaluate the developmental processes in ASD.

1:57 **152.002** Early Developmental Trajectories of Social Contingency Predict Language Outcome in Toddlers with ASD

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Background: Although deficits in speech and language are no longer part of the definition of autism, most children with ASD are delayed in acquiring spoken language, and many of those children never learn to speak. A significant body of research has recently demonstrated the importance of contingent interaction between infant and caregiver in stimulating vocal development, and it is possible that early deficits in social interaction, which are a core feature of the syndrome, are responsible for later deficits in speech acquisition. If this is correct, early biomarkers quantifying the development and derailment of social engagement in infancy should be useful in predicting later language, and identifying developmental pathways that can be targeted by early intervention.
Objectives: The goal of this study was to test whether early developmental trajectories of social contingency between infant and caregiver over 0-24 months predict later language outcome at two years of age.
Methods: As part of an NIH Autism Center of Excellence, we tracked vocal development in 44 high-risk infant siblings and 30 low-risk controls. Using a recording device (LENA) worn by each child, we made audio recordings of each child's language environment at monthly intervals from 0-24 months. Using automatic speech recognition technology developed in our laboratory, we counted the number of vocalizations per hour for child and adult, as well as the rate of contingent interactions based on timing statistics. Using Functional Data Analysis, we calculated developmental trajectories for each child as well as mean trajectories for each group. We found significant differences in all three trajectories between risk groups, but these differences emerged at different time points. Starting at around 12 months, low-risk infants show a significant increase in the number of vocalizations they make, the number of times adults vocalize back to them, and the rate of conversational turns between adult and child. In contrast, high-risk infants show no increase in contingent interaction, which may be an early sign of autism. Three months later, adult vocalizations begin to decline. After a further three months, high-risk infants lag behind their low-risk peers. The disruption of the natural process of vocal interaction between infant and caregiver clearly demonstrates the developmental cascade of derailment that unfolds from early deficits in social engagement. To determine the impact of this process on later language outcome, we examined the correlation between receptive and expressive language scores from the Mullen Scales of Early Learning for children who completed clinical assessments at 24 months, and the slope and intercept of a two-parameter exponential growth curve fitted to every child's data.
Results: We found significant correlation (r=0.399, P<0.05) between the expressive language score and the slope of the trajectory for conversational turns; surprisingly, no other correlations were significant.
Conclusions: Infants at risk of ASD undergo a developmental cascade of derailments that begins with an early decline in contingent interaction that predicts lower expressive language, consistent with the hypothesis that core deficits in social engagement associated with ASD are responsible for comorbid deficits in spoken language.

2:09 **152.003** The Fluid Nature of the Very Early ASD Phenotype: Examination of Diagnostic Stability of ASD within a General Population Cohort

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Background:
Very early detection (between 12-24 months) and early treatment have been flagship goals of government regulatory bodies such as the IACC, parent, and advocacy groups alike. Determining how early autism can be accurately recognized, and the stability of ASD once it is suspected, is still unclear. Almost all that is known in this area comes from baby-sibling studies. One such study by Ozonoff and colleagues, noted strong diagnostic stability of toddlers identified as ASD at 18 months (92% stability), however approximately half of the children diagnosed with ASD at 3 years were not identified as ASD when previously tested at 18 or 24 months. The stability of diagnoses in such baby sibling studies are usually presented in dichotomous terms: ASD or Not ASD, making it challenging to understand how a toddler initially identified around 18 months as typical or with a non-ASD delay may end up with an ASD diagnosis at age 3 years or vice versa. Understanding not only the stability of ASD identification in toddlers, but how this designation may be blurred across diagnostic boundaries across the first 3 years of life in a general population cohort is essential.
Objectives:
(1) To examine diagnostic stability of ASD starting at 12 months in age in the general population. (2) To determine the proportion of changes across diagnostic boundaries.
Methods:
545 toddlers at-risk for ASD and other delays between 12-24 months identified in the general population using the 1-Year Well-Baby Check-Up Approach, which centered around using the CSBS IT Checklist at pediatric well-baby visits, participated (M= 15mo). Toddlers participated in a comprehensive developmental evaluation and were followed every 6-9 months until their 3rd birthday when a final diagnosis was given (M= 37 mo). Developmental evaluations at every age were conducted by Ph.D. level licensed psychologists and diagnostic judgments for a range of delays (ASD, ASD features, language delay, global developmental delay, motor delay, etc.) at each age were tracked.
Results:
Overall, diagnostic stability of ASD between 12-24 months (~80%) was lower in this general population cohort in comparison to reports from baby sibling studies that report levels as high as 92%. Eight percent of toddlers initially considered ASD at intake age were given a designation of ASD-features at final diagnosis age, 8% showed a non-ASD delay (e.g., language delay), and 4% were considered typical. Similar to baby sibling studies, a large percentage of cases were not designated as ASD initially. Common diagnostic transitions included language delay to ASD (16% of final ASD sample) and global developmental delay to ASD (30%).
Conclusions:
While diagnostic stability of ASD as identified in toddlers in the general population may not be as high as noted in baby sibling cohorts, all but 4% of cases retained some delay designation at final diagnostic age, suggesting that stability of having a delay in general is extremely high (>95%). The persistence of deficits in key skills such as language and social behavior of toddlers initially identified as ASD warrant early treatment regardless of final diagnostic designation.

2:21 **152.004** Developmental Profile of Low Risk Children with Autism Spectrum Disorder during the First Two Year of Life

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Background:
Early recognition of autism spectrum disorder (ASD) enables early interventions which had been shown to improve clinical outcome. Defining the patterns of developmental trajectory of children with ASD across different developmental domains can contribute to better understanding of the neurobiology of ASD and to improved screening tools and earlier referral for diagnosis. Data regarding the acquisition of developmental milestones in children with ASD is scares and mostly derived from retrospective recall of parents. In Israel a nationwide computerized well care baby system contains data on children's achievement of developmental milestones gathered prospectively by a trained nurse during routine checkups in the first years of life. This database enables a prospective outline of the developmental trajectory across several developmental domains using uniform scales in different population groups.
Objectives: To outline the acquisition of milestones in different developmental domains in low risk children later diagnosed with ASD compared to typically developing (TD) children and to identify early signs observed in routine well care baby checkups that could indicate referral for further evaluation.
Methods:
We compared early developmental data of 355 children with ASD to matched 416 typically developing children using the well care baby database. Data was prospectively collected at 6 weeks and 3, 6, 9, 12, 18 and 24 months during regular checkup visits. In each visit 5 to 6 items representing different developmental domains (gross motor, fine motor, social, receptive and expressive language) were evaluated and recorded. Children with major developmental disabilities (such as cerebral palsy, genetic syndromes) and risk factors (such as prematurity) were excluded.
Results: Difference in acquisition of milestones between ASD a TD groups emerged at 9 months. 31% of children in ASD group failed the receptive language item compared to 12% in the TD group (p=0.0001), 40% in ASD group failed the gross motor item compared to 22% in TD group (p=0.002), 19% of ASD group failed the fine motor item compared to 8% in TD group (p=0.003), 16% of ASD group failed the social item compared to 9% of TD group (p=0.05). Difference in the expressive pre-verbal item was non-significant. At 12, 18, 24 months, differences between groups were highly significant in all developmental domains.
Conclusions:
Deviation from typical developmental trajectory is observed early, at nine month of age, in low risk children later diagnosed with ASD. This difference is especially prominent in receptive language and gross motor domains. Children representing these developmental delays should be closely monitored for communication deficit, for early diagnosis and treatment.

Oral Session - 9B
153 - Behavior in High-risk Infants
2:40 PM - 3:30 PM - Yerba Buena 9

Session Moderator: Jessica Brian, *Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada*

2:40 **153.001** Neural Correlates of Early Language Processing in 9-Month-Old Infants at Risk for ASD

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Background: Language delays are one of the earliest autism-related concerns that parents report. Infants who develop autism spectrum disorders (ASD) often exhibit atypicalities in their early language profiles (e.g., Hudry et al., 2014). Moreover, toddlers with ASD and significant verbal delays show hypoactivity in canonical temporal language-processing regions during speech processing (e.g., Lombardo et al., 2015). Since language learning appears to be gated by the social brain (Kuhl, 2007), early deviations in language processing may index altered social development prior to overt deficits in social or verbal skills. Examining language processing during foundational stages of language acquisition may thus inform risk for ASD and later language difficulties.
Objectives: We examined the neural circuitry subserving language processing in 9-month-old infants at high (HR) and low risk (LR) for ASD to identify patterns of brain activity that may predict altered trajectories in language development and ASD risk. This will further substantiate the role of language in the early manifestation of ASD.
Methods: 19 HR and 13 LR infants underwent fMRI during natural sleep and were presented with speech samples produced by different female native speakers of English and Japanese. Both English and Japanese stimuli were matched for duration, intensity, peak amplitude, pitch, and pitch range. English and Japanese speech segments (8 segments per language, each lasting18s) alternated between periods of silence (12s each) in a traditional fMRI block-design. Individual data were registered to an infant atlas; preprocessing (including motion censoring) and statistical analyses were conducted in FSL. Behavioral measures of language, cognitive, and social functioning were assessed at 12 months [i.e., Mullen Scales of Early Learning (MSEL), Vineland Adaptive Behavior Scale (VABS), and Autism Observation Scale for Infants (AOSI)].
Results: Relative to LR infants, HR infants showed hypoactivity for both English and Japanese in temporal and frontal language regions, the cerebellum, and regions associated with attention (precuneus) and reward (amygdala, and caudate nucleus). In particular, LR infants showed greater activity in left temporal pole and caudate nucleus than HR infants for English, the infants' native language. The relation between neural activity for English and 12-month Verbal T Scores from the MSEL were also examined. For LR infants, greater activity in temporal language areas at 9 months predicted better verbal scores at 12 months. In contrast, for HR infants, better verbal scores were inversely related to activity in the precuneus and medial prefrontal cortex, the hubs of the default mode network (DMN), a resting-state network that is most active during passive rest and deactivated during information processing. Mean activation in these DMN hubs during language exposure was negatively correlated with 12-monthVineland Socialization Scores (r =-0.61, p= 0.01).
Conclusions: HR infants already show attenuated neural responses to language at 9 months, prior to overt signs of atypical development. The distinct patterns of brain activity during native language processing and its association with later verbal skills suggest that HR infants may be less attuned to the language inputs of their immediate environments, with negative downstream effects for language and social development.

2:52 **153.002** Parent and Clinician Agreement in Early Behavioural Signs in 12-Month-Old Infants at-Risk of Autism Spectrum Disorder: A High-Risk Sibling Cohort

L. A. Sacrey[1], *L. Zwaigenbaum*[2], *S. E. Bryson*[3], *J. A. Brian*[4], *I. M. Smith*[5], *W. Roberts*[6], *P. Szatmari*[7], *T. Vaillancourt*[8], *C. Roncadin*[9] *and N. Garon*[10], *(1)Autism Research Centre, Edmonton, AB, CANADA, (2)University of Alberta, Edmonton, AB, CANADA, (3)Dalhousie University, Halifax, NS, CANADA, (4)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (5)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (6)University of Toronto, Toronto, ON, CANADA, (7)Centre for Addiction and Mental Health, Toronto, ON, CANADA, (8)University of Ottawa, Ottawa, ON, CANADA, (9)Autism Spectrum Disorder Service, McMaster Children's Hospital - Hamilton Health Sciences, Hamilton, ON, CANADA, (10)Mount Allison University, Sackville, NB, CANADA*

Background: Identifying early impairments in children who will subsequently be diagnosed with Autism Spectrum Disorder (ASD) is crucial to ensure that they gain timely access to interventions that will improve functional outcomes. Although prospective studies of high-risk infants have increasingly focused on direct observation of infants' behaviour during interactive assessments, prospective parent reports may provide valuable and complementary information.
Objectives: The purpose of this study was to examine parent and clinician agreement at 12 months of age for the clinician observational assessment, the Autism Observation Scale for Infants (AOSI; Bryson et al., 2008), and the parent-report questionnaire, the Autism Parent Screen for Infants (APSI; Sacrey et al., 2016), which was modeled in content from the AOSI.
Methods:
Participants: High-risk infants (HR; have an older sibling diagnosed with ASD) were divided into two groups based on an independent expert clinical assessment using the ADOS and ADI-R at 36 months of age: HR siblings who *did not* receive an ASD diagnosis (HR-N; n = 155) and HR siblings who *did*receive a diagnosis of ASD (HR-ASD; n = 68).
Assessments: The APSI (Sacrey et al., 2016) is a 26-item parent-report questionnaire that complements the AOSI observational assessment (Bryson et al., 2008). These assessment tools share 19 items that cover early symptomatology of ASD. Parents completed the APSI and clinicians completed the AOSI at 12 months of age.
Statistical Analyses: Performance on the APSI and AOSI was compared between the two HR groups using independent t-test analyses. Agreement between parents and clinicians for the shared 19 items was analyzed using intraclass correlations.
Results: Intraclass correlations of AOSI and APSI items indicated poor agreement between parents and clinicians, ranging from -.06 to .23 for the combined group, -.06 to .30 for the HR-ASD group, and -.05 to 19 for the HR-N group. Item-level comparisons using independent t-tests indicated: (1) six items were informative in predicting diagnostic outcomes on both the AOSI and APSI, including responding to name, eye contact, hand-eye coordination, unusual sensory behaviours, engagement of attention, and shared interest (ps< .05), (2) six items were informative on the APSI only, including visual fixation, anticipating a social interaction, back-and-forth vocalizations, social smiling, reactivity, and repetitive motor behaviour (ps< .05), and (3) seven of the items were not informative on either assessment, including visual tracking, reacting to change in facial expression, imitation, showing interest and pleasure, transitions, difficulty using hands, and insistence on same object.
Conclusions: Prospective parent report is informative for early signs of ASD by 12 months and complements what may be elicited / observed during an interactive assessment. Some clinically informative behaviour may be more likely detected by parents based on their day-to-day observations than during a brief clinical visit.

3:04 **153.003** Patterns of Face Gaze Among Infants at Risk for ASD

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Background: The core deficits of Autism Spectrum Disorder (ASD) can reliably be observed and classified by two years (Lord et al., 2006; Chawarska et al., 2009). Recent research has aimed to understand whether atypical behaviors that characterize ASD in toddlerhood (e.g., limited eye contact, decreased interest in faces) emerge in the first year of life. Behavioral observations of high-risk (HR) siblings later diagnosed with ASD suggest that face gaze may be preserved early in infancy, at 6 months of age, but declines significantly by 12 months (as reviewed in Jones et al., 2014). However, as previous studies have either exclusively evaluated mother-infant interactions or have examined face gaze during a general evaluation (e.g., Mullen), this is the first study to evaluate gaze patterns in HR-infants using a standardized social interaction procedure between an examiner and infant.
Objectives: To investigate patterns of face gaze directed at an experimenter using a novel interactive procedure at 6, 9, and 12 months among HR siblings who later develop ASD (HR-ASD), HR siblings who do not receive an ASD diagnosis (HR-nASD), and typically developing low-risk children (LR-TD).
Methods: Participants included 184 infants (HR-ASD, *n*=21; HR-nASD, *n*=104; LR-TD, *n*=59) who completed Social Orienting Probes at 6, 9, and 12 months and were evaluated for ASD at 24 and 36 months. Trained examiners administered a series of 1-minute probes designed to elicit attention through several means: a) motherese, b) song, and c) peek-a-boo. Videotaped sessions were coded offline by blinded coders for the duration of time, in seconds, that the infant looked at the examiner's face. Face gaze was calculated as the proportion of time spent looking at the examiner's face during each probe (%Face). Generalized linear mixed model analyses were used to examine the fixed effects of diagnostic group, probe, infant age, and their interactions on %Face, followed by planned contrasts using the sequential Bonferroni correction.
Results: Analyses of %Face revealed a main effect of diagnosis ($F(2, 1395)=4.4$, $p<.05$; HR-ASD<HR-nASD=LR-TD), a main effect of probe ($F(2, 1395)=245.3$, $p<.01$; peek-a-boo>song>motherese), no main effect of infant age ($p=.58$), a significant group x age interaction ($F(4, 1395)=2.7$, $p<.05$), and no three-way interaction ($p=.11$). Planned comparisons indicated that groups differed significantly only at 6 months across all probes, such that HR-ASD<HR-nASD=LR-TD ($p=.001$; see Figure 1).
Conclusions: Results of these analyses diverge from previous literature by revealing differences in infants' face gaze at 6 months, but not at 9 or 12, between HR-infants who are later diagnosed with ASD, unaffected HR-siblings, and LR-TD children during a standardized behavioral paradigm. The finding that ASD infants spend less time orienting to the face of an interactive partner contributes to evidence from neuroimaging (Wolff et. al., 2012), neurobehavioral (Chawarska et al., 2013; Shic et al., 2014), and neurophysiological (Elsabbagh et al., 2012) data that subtle abnormalities related to later emerging ASD can be detected as early as 6 months. This suggests a potential sensitive period early in infancy for the development of social cognition that may be highly influenced by social orienting and attention.

3:16 **153.004** Now You See It, Now You Don't: Context-Dependent Dyadic Vulnerabilities in Infants with ASD in the First Year of Life.

***S. Macari**, A. Milgramm, P. Heymann, F. E. Kane-Grade, E. Hilton and K. Chawarska, Yale Child Study Center, Yale University School of Medicine, New Haven, CT*

Background:
The majority of studies of high-risk (HR) infant siblings with ASD have found little evidence of social abnormalities at six months of age, including social smiling, response to name, and gaze to a social partner (Bryson et al, 2006; Landa et al., 2007; Ozonoff et al., 2010; Nadig et al., 2007; Rozga et al., 2011; Young et al., 2009). Context may be key to revealing vulnerabilities, however. For example, video segments in which a person addressed the viewer using child-directed speech elicited longer looks away from the screen by toddlers with ASD, while segments containing the person engaging in other activities attracted their attention comparable to controls (Chawarska et al., 2012). Little is known about the effects of context within live interactions on social behavior of infants at risk for ASD.
Objectives:
To examine differences between 6-12-month-old infants later diagnosed with ASD and controls in social attention and directed affect during a variety of dyadic interactions with an examiner.
Methods:
184 infants at HR and low risk (LR) for ASD participated in a standardized social interaction with an examiner at 6, 9, and 12 months of age, and were evaluated for ASD by blinded psychologists at 24/36 months: HR-ASD; *n*=21, HR without ASD (HR-nASD; *n*=104) or LR typically-developing (LR-TD, *n*=59).Â Examiners administered a series of one-minute probes: speaking in motherese, singing, playing peek-a-boo, engaging in a tickle game, and demonstrating a toy. Sessions were videotaped and coded offline by blinded coders for infants' visual attention (looking at examiner's face) and affect (directed positive/negative affect), standardized over the length of each probe (%Face and %DirAffect). Hypotheses were evaluated using linear mixed models followed by planned contrasts.
Results:
Anaylsis of %Face revealed main effects of group ($F(2,2360)=8.78$, $p=.001$; HR-ASD<HR-nASD=LR-TD) and probe ($F(4,2360=15025.02$, $p<.001$; toy<tickle=motherese<song<peek-a-boo), a significant probe by group interaction ($F(8,2360)=2.67$, $p=<01$), and a significant age bygroup interaction ($F(3,2360)=3.59$, $p<.01$). Planned contrasts indicated that the HR-ASD group looked less at the examiner than both the HR-nonASD and LR-TD groups during motherese and tickle (ps<.05) but at rates similar to controls during peeka-a-boo, song, and toy probes. All three groups differed from each other at 6 months but not at other ages (*p*s<.05). Analysis of %DirAffect revealed main effects of group ($F(2,2394)=7.12$, $p=.001$; HR-ASD<HR-nASD<LR-TD), probe ($F(4,2394)=154.26$, $p<.001$; toy<song=motherese<tickle<peek-a-boo), and age ($F(2,2394)=5.21$, $p<.01$; 6mo<12mo), and a significant probe by group interaction ($F(8,2394)=1.94$, $p=.05$). Planned contrasts indicated that the HR-ASD group directed less affect to the examiner than the LR-TD group during peek-a-boo and tickle (*p*s<.05) but at rates similar to controls during the motherese, song, and toy probe.
Conclusions:
Infants age 6-12 months later diagnosed with ASD expressed vulnerabilities in social attention and shared affect during certain interactions but not others. The tickle and motherese episodes elicited less modulated social attention, while the tickle and peek-a-boo episodes exposed diminished sharing of affect compared to controls. As in eye-tracking studies presenting complex social content, varied in-vivo context can elicit vulnerabilities or be an equalizer for infants in the first year who later develop ASD.

Oral Session - 10A
154 - International and Cultural Perspectives on Family Wellbeing
1:45 PM - 2:35 PM - Yerba Buena 10-14

Session Moderator: Mayada Elsabbagh, *McGill University, Montreal, CANADA*

1:45 **154.001** Profile and Impact of Participating in a Parent Support Group in Latin America

J. P. Berman[1,2], *S. H. Cukier*[2], *R. A. Garcia*[3], *G. Garrido*[4], *C. Montiel-Nava*[5], *C. S. Paula*[6], *A. Rattazzi*[2], *A. Rosoli*[7] *and D. Valdez*[8], *(1)The Fulbright Program, Buenos Aires, Argentina, (2)PANAACEA, Programa Argentino para Niños, Adolescentes y Adultos con Condiciones del Espectro Autista, Buenos Aires, Argentina, (3)Universidad de Chile, Santiago, CHILE, (4)Universidad de la República, Montevideo, URUGUAY, (5)La Universidad del Zulia, Gainesville, GA, (6)Developmental Disorder Program, Mackenzie Presbyterian Univesrsity, Sao Paulo, BRAZIL, (7)OEI, Santo Domingo, Dominican Republic, (8)FLACSO, Buenos Aires, Argentina*

Background: Parent support groups (PSGs) have been shown to be an effective coping mechanism for parents of children with disabilities, reducing stress and improving quality of life. PSGs related to ASD in Latin-America have been instrumental in the development of research, resources, and advocacy, playing major roles in policy and awareness campaigns. Only a few studies have investigated the profile and impact of participating in ASD-specific PSGs, and mostly in North America.
Objectives: The objective of this study is to describe the profile of Latin-American families affected by ASD participating in PSGs compared to those not in PSGs, and to analyze the possible impact of being in a PSG in the Latin-American region on quality of life, access to services and attitudes towards stigma.
Methods: A needs survey for caregivers of people with ASD was performed in the Latin-American Region between 2015-2016 by the Red Espectro Autista Latinoamerica (REAL). 2965 families were surveyed in six Latin-American countries using the Autism Speaks Caregiver Needs Survey. The profile and impact of participating in a parent/family association was analyzed in this sample, considering: demographic characteristics, subjective quality of life, access to resources, satisfaction with services, and perception of stigma.
Results: Twenty-seven percent of survey respondents across countries reported having a family member who currently participates in a PSG. Participating in a PSG showed a very significant association with having more access to services; 29% of people not in PSGs reported receiving no services or treatment for the person with autism, while only 14% of the PSG group reported the same. Meanwhile, more than half of the PSG group reported receiving 3 or more types of services or treatment (compared to only 37% in the non-PSG group).
PSG involvement was also associated with fewer feelings of impotence and less perception of stigma; however, caregivers in the PSG group reported more financial impact of having a child with autism.
More people participating in PSGs had children in the 6-11 age range, and with lower level of functioning. No significant differences were found in sex, language level, cognitive level, problem behaviors or educational level of caregivers.
Conclusions: PSG participation showed a strongly significant association with access to services. Other factors that could be affecting access to services, like educational level of caregivers or distance from site of diagnosis, did not show significant differences between groups. Participation in PSGs might increase awareness of community prejudices and the existence and efficacy of treatments.
People in PSGs report fewer feelings of impotence and less concern about people knowing about their child's diagnosis, but are more conscious of the possibility of discrimination. Participating in a PSG might be a way of actively coping with having a family member with ASD.
PSGs have an important role for families in Latin-America, shown not only by the amount of families reporting participation, but also by the concrete benefits regarding access to services, feelings of empowerment, and more optimistic perceptions towards having a child with ASD.

1:57 **154.002** Stress, Coping, Stigma and Acculturation in Arab American Caregivers of Children with Autism Spectrum Disorder

S. I. Habayeb[1], *B. Rich*[1], *S. Dababnah*[2] *and A. John*[3], *(1)Catholic University of America, Washington, DC, (2)University of Maryland, Baltimore, Baltimore, MD, (3)Texas Christian University, Fort Worth, TX*

Background: Few studies have examined stress and coping in caregivers from minority ethnic or cultural groups raising children with an Autism Spectrum Disorder (ASD), such as caregivers in the Arab American community. The Arab American community is one of the fastest growing, yet least studied ethnic communities in the U.S. (Al Khateeb, Al Hadidi, & Al Khatib, 2014). An estimated 23,000 Arab American children in the U.S. live with a disability, however no research has focused specifically on ASD in this population.
Objectives: The current study aims to examine acculturation, stigma, stress and coping among Arab American caregivers caring for a child with ASD.
Methods: Arab American caregivers of children with ASD participated in this study. Participants completed a set of online questionnaires about their experience caring for their child with ASD, including: Family Stress and Coping Interview (Nachshen, Woodford, & Minnes, 2003), Brief COPE (Carver, 1997), Sources of Social Support Scale (Carver, 2006), The Support Questionnaire (Tehee, Honan, & Hevey, 2009), Adapted Perceived Stigma Scale (Mickelson, Wroble, & Helgeson, 1999; Rosenblum-Fishman, 2013), and The Male Arab American Acculturation Scale (Barry, 2005). Some participants participated in a follow-up phone interview to elaborate upon the stressors and support systems that they indicated on their survey responses.
Results: Data collection is currently underway, and by May 2017, we expect to have approximately 30 participants. Preliminary descriptive data is presented based on the eight participants who have completed the study to date. All respondents were mothers and seven were first generation immigrants (years in home country *M*=17.14, *SD*=9.18). Six children were male, and their mean age was 8.25 years (*SD*=4.08). Autism Society/Disability Organizations were the highest rated formal support systems. Caregivers reported a moderate level of support from their spouses (*M*=32.67, *SD*=12.13, Range = 10-50) and moderate to low levels of perceived stigma (*M*=21.88, *SD* =2.64, Range = 8-40). In regard to acculturation, caregivers endorsed greater levels of Assimilation over Separation (*M*=12.38, *SD*=3.93, Range = 7-28) and greater levels of Integration over Marginalization (*M*=21.88, *SD*=5.22, Range = 7-28). With the complete dataset, correlation analyses will be utilized to examine the relationships among perceived stigma, support, stress and coping variables in the sample. We expect to find a negative relationship between stress and positive coping, between perceived stigma and positive coping, and between acculturation and perceived stigma, along with a positive relationship between perceived stigma and stress. Qualitative data from the interviews will be analyzed using a grounded theory approach (Strauss & Corbin, 2008). General themes emerging from the qualitative interviews, to date, are insurance related obstacles and issues navigating school-based services.
Conclusions: Â Findings from this study will be discussed in the context of their implications for practice and future research. As such, results of this study have the potential to increase clinicians' awareness and cultural responsiveness in order to support Arab American families of children with ASD. Furthermore, results from this study will contribute to the development of culturally-sensitive interventions and advocacy programs designed to directly target the specific needs of this community.

2:09 **154.003** Bcri: A Family-Based Early Behavioral Intervention Program for Children with Autism Spectrum Disorders in Chinese Population

B. Chen[1], *F. Wang*[2] *and X. Zou*[3], *(1)Children Developmental & Behavioral Center, SUN YET-SEN UNIVERSITY, Guangzhou, Guangdong, China, (2)Child Developmental & Behavioral Center, Third Affiliated Hospital of SUN YAT-SEN University, GUANGZHOU, CHINA, (3)The Third Affiliated Hospital of Sun Yat-Sen University, Guangzhou, China*

Background: Autism Spectrum Disorder (ASD) is considered to be an early onset neurodevelopmental disorders characterized by qualitative social interaction impairments and repetitive stereotyped behaviors/restricted interests. However, strong evidence shows that promoting a structural early-intervention model may positively influence outcomes of ASD as well as reduce the burdens of lifetime care demands for society.
Objectives: BCRI intervention program aims to empower the parents to master appropriated approaches and strategies of BCRI early behavioral intervention, and provide positive affects to the clinical outcome for children with ASD.
Methods: 130 children diagnosed with ASD between the ages of 18 and 30 months were randomly assigned to the early BCRI group and CI group (community intervention). Both BCRI group and CI group participate in a two-day ASD seminar to receive basic knowledge about behavioral intervention in Phase-one. In Phase-two, BCRI group participate in a 24-halfday workshop to gain hands-on experience and one-on-one training from master trainers, then these family take another 11 months to implement BCRI intervention to their children in home settings, and CI group receives community service. Psycho-educational Profile-3rd Edition (PEP-3) assessment indexes were collected, and single and multiple Wilcoxon signed rank test were performed for statistical analysis.
Results: 85 participants (53 in BCRI group, 32 in CI group) completed primary endpoint at one year after enrollment. Statistically significant post-intervention improvements were found in BCRI group, which included Cognitive Verbal/Proverbial (CVP), Expressive Language (EL), and Receptive Language (RL) subsets in the Communication domain ($p<0.05$). By Comparison of pre- and post-intervention between BCRI and CI group, significant improvements were reported in combined score of Communication domain (CVP, EL, RL) plus Fine motor (FM) subset ($p<0.05$), and in combined score of Visual Motor Imitation (VMI) subset and FM subset ($p<0.05$).
Conclusions: It's the initial large sample randomized controlled study for family-based early behavioral intervention for ASD. We suggest that BCRI Intervention model have positive effects for children with ASD, to develop early communication skills as well as visual motor Imitation and fine motor skills. BCRI model emphasize the initial appliance of behavior management and problem solving strategies, which following by structural teaching infrastructure with appropriate level of education. BCRI also emphasize to emerge 'relationship elements' as part of social interaction intervention throughout every step of BCRI model, to Improve social skills of children with ASD. The study indicated that BCRI model is an effective early behavioral intervention method for child with ASD, and the feasibility to implement in middle-income countries.

2:21 **154.004** Mediators Between Receiving Early Interventions and Unmet Services Needs in Children: Findings from a Canadian National Survey

J. Lai[1] *and J. A. Weiss*[2]*, (1)Psychology, York University, Montreal, QC, CANADA, (2)York University, Toronto, ON, CANADA*

Background: Navigating the service sectors for children with ASD is a challenge for many caregivers, leading to a high level of burden and distress. Having an ID changes the dynamics of how service access. The early developmental period is a sensitive window for clinical outcomes; however, it is not known how access to early intervention relates to outcomes such as receiving other services. Articulating the relationship between having accessed early intervention services and unmet service need through mediating factors will provide a better understanding of how families navigate services and ways to support them better.
Objectives: The objective of this study was to identify the relationship between receiving early interventions and unmet service needs, and the demographic and clinical correlates for children with ASD across Canada, with and without ID.
Methods: An online survey was administered across Canada through the Canadian Autism Spectrum Disorders Alliance, completed by 3251 caregivers reporting on 3317 family members with ASD. Analysis was done on reports of 1704 children up to the age of 12 years. Participants indicated if they had ever received early intervention services, our independent variable. An unmet need score, our dependent variable, was created by summing the number of services they never received but would have liked to receive. Demographic, clinical and systemic factors were collected. Two mediator analyses, one for those with ASD and ID, and one for those with ASD alone, examined the factors that explained the relationship between getting early intervention services and unmet need.
Results: Overall, the mean age of receiving an ASD diagnosis was 3.89 (SD=1.9) years, and 86% of the sample had received early intervention services. The number of unmet needs was 3.78 (SD=2.6). Between the ASD alone (n=705) and ASD+ID (n=999) groups, those with ASD alone were diagnosed later ($p<.001$), had less caregiver services ($p<.001$), endorsed less systemic barriers to accessing services ($p<.05$), had less service receipt ($p<.01$), less concerning behaviours ($p<.001$), and lower health function score ($p<.001$) as defined by body function categories in the International Classification of Functioning, Disability and Health framework. They were also less likely to be in financial trouble ($p<.05$). After controlling for age, ethnicity and number of years in Canada, for children with ASD+ID, accessing early intervention did not relate to the level of unmet need ($p=.10$). However, for those with ASD alone, accessing early intervention was related to lower unmet need ($t=4.87$, $p<.001$). Mediators of this relationship were having caregiver-directed services, less mental health concerns, less behavioural concerns, and a younger age of diagnosis.
Conclusions: These results indicate that ID status plays a large role in how services are accessed. For individuals with ASD and no ID, access to early interventions led to less unmet need receipts, as a result of greater access to caregiver services and lower clinical need. In children with both ASD+ID, this relationship was not present. Discussion of the implications of these findings will follow.

Oral Session - 10B
155 - International and Cross-cultural Perspectives on Early Identification
2:40 PM - 3:30 PM - Yerba Buena 10-14

Session Moderator: Mayada Elsabbagh*, McGill University, Montreal, CANADA*

2:40 **155.001** Change over Time in the Age and Number of Children Accessing Autism Specific Funding in Australia

C. A. Bent[1]*, J. Barbaro*[1] *and C. Dissanayake*[2]*, (1)Olga Tennison Autism Research Centre, School of Psychology & Public Health, La Trobe University, Melbourne, Australia, (2)School of Psychology & Public Health, Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia*

Background: The early identification and diagnosis of individuals with Autism Spectrum Disorder (ASD) is a critical step in the pathway through to early intervention and support services. Access to autism specific intervention and funding services is largely dependent on a diagnosis of ASD. Factors found to influence the age that a child is first diagnosed include child and family characteristics (such as cultural background and the severity of symptoms) as well as characteristics specific to the health system and services. Examining trends over time allows us to investigate the influence of changes within the service environment, such as the introduction of the revised diagnostic criteria (DSM-5) in 2013.
Objectives: The aim of the current study was to examine change over time in the age and number of children diagnosed with ASD and accessing autism specific funding, both prior to and following the introduction of the DSM-5.
Methods: This study utilised a large administrative data set regarding 32,199 children aged under 7 years who had received a diagnosis of ASD in the community (confirmed by a Pediatrician or multidisciplinary team assessment) and registered to receive autism specific funding through the Helping Children with Autism Package (HCWA) in Australia from January 2010 to June 2015.
Results: The average age and number of children diagnosed with ASD and registered to receive autism specific funding were both observed to increase over time; with increases in the frequency of diagnoses generally corresponding with a parallel increase in the average age of diagnoses (see Figure 1). The estimated annual incidence of children diagnosed with ASD and registered with HCWA increased from 20 per 10,000 in 2010 to 34.2 per 10,000 in 2013. Following the introduction of the DSM-5 in 2013, the estimated annual incidence of ASD plateaued, with no further significant increase in incidence evident from 2013 to 2015.
Conclusions: Characteristics of the service environment influence the average age and number of children diagnosed with ASD in a community. The parallel trends of increasing age and frequency of diagnoses observed in this study suggest that an increase in the number of children diagnosed with ASD in Australia has contributed to an increase in demand for diagnostic services, and slightly longer waiting lists. These findings also suggest that the introduction of the comparatively more stringent diagnostic criteria (DSM-5) may have contributed to an attenuation of the trend of increasing diagnoses over time; whereby relatively fewer children have received a diagnosis of ASD and registered to receive autism-specific funding since its introduction.

2:52 **155.002** Where Are All the Children with Autism Spectrum Disorder (ASD) in South Africa? a Comprehensive Database Search for All School-Aged Children with ASD in the Western Cape Province

S. Pillay[1], *M. E. Duncan*[2] *and P. J. de Vries*[3], *(1)Health Sciences, University of Cape Town, Cape Town, South Africa, (2)University of Cape Town, Cape Town, South Africa, (3)University of Cape Town, Cape Town, SOUTH AFRICA*

Background:
Little is known about Autism Spectrum Disorder (ASD) in Africa where the prevalence remains unknown. However, even in Africa the increase in ASD combined with better awareness and knowledge has resulted in more children being diagnosed and referred to educational services.
South Africa is considered one of the best resourced African countries in terms of ASD services. However, no study to date has sought to identify children with ASD in a specific education system in order to evaluate needs, determine capacity, and generate comprehensive, evidence-based, sustainable and scaleable solutions to the increasing demand for appropriate education for children with ASD.
Objectives:
The study objective was to perform a comprehensive database search of all children with ASD in the formal education system in the Western Cape Province of South Africa. An understanding of the number, ages, gender, geographical distribution and other socio-economic and cultural variables would contribute to a larger-scale situational analysis of services and service needs for school-aged children with ASD.
Methods:
A quantitative non-experimental descriptive design was used to provide numeric descriptions of the population of children with ASD on the Western Cape Education Departments (WCED) database. The Centralised Education Management Information System (CEMIS) is a web-enabled information management system used for registration and tracking of all children in the WCED. All data relating to children with ASD were extracted on 27 June 2016 from the existing dataset. The main variables of interest included disability information, demographic information and educational information.
Results:
A total of 940 children with a primary or secondary diagnosis of ASD were reported from a population of 1 063 349 school-going children in the province. This accounts for 0.0884% of the school-aged population. The overall male: female ratio was 5.48:1. Self-reported race and language patterns show that the majority of children with ASD in the province were Coloured (42%) and English speaking (61%). 90% of children with ASD were in schools for children with Special Educational Needs and only 10% were in Ordinary/Mainstream schools. 83% of the ASD school-going population were in urban areas and 17% attend schools in rural areas. Intellectual disability was reported in only 19% of the population. Low rates of co-morbid mental health disorders such as attention deficit disorder (2%) and epilepsy (1%) were reported. Interestingly data shows a 76.03% increase in ASD in schools from 2012 to 2016, with an average increase of 15.18% per annum.
Conclusions:
The comprehensive database search in the Western Cape Province of South Africa, showed a concerningly low rate of children identified with ASD. Most of those were in special educational settings, with very low identification of comorbid neurodevelopmental and mental health diagnoses. Results suggests that, even in one of the best resourced provinces of South Africa, there is likely to be a very significant under-identification of ASD in school settings. We propose that large-scale and systematic evaluation of educational systems for children with ASD in the Province and in South Africa should be performed.

3:04 **155.003** Disparities in the Diagnosis of Autism Spectrum Disorder According to Aboriginality and Remoteness

J. Fairthorne[1,2], *H. Leonard*[3], *J. Bourke*[4], *A. J. Whitehouse*[5], *N. de Klerk*[6] *and C. Shepherd*[7], *(1)Disability, Telethon Kids Institute, Subiaco, Perth, AUSTRALIA, (2)British Columbia Children's Hospital Research Institute, Vancouver, Canada, (3)Disability, Telethon Kids Institute, West Perth, AUSTRALIA, (4)Disability, Telethon Kids Institute, Perth, Australia, (5)Telethon Kids Institute, University of Western Australia, Perth, Australia, (6)Biostatistics, Telethon kids Institute, Perth, Australia, (7)Aboriginal Health, Telethon Kids Institute, University of Western Australia, Perth, Australia*

Background:
While Aboriginal children suffer persistent disadvantages across most measurable aspects of health and wellbeing, research indicates that they have an 80% lower prevalence of autism spectrum disorder (ASD) with comorbid intellectual disability (ID).
Objectives:
We estimated the prevalence of ASD with ID in children born from 1983-2005 in Western Australia according to Aboriginality, geographic remoteness and over time. In this way, we aimed to clarify whether the lower rate amongst Aboriginal children is a function of access to diagnostic services and whether access is improving over time.
Methods:
We linked registry data to access information on Aboriginality, remoteness, birth year and the diagnosis of ASD with ID in all children born from 1983-2005 in Western Australia. Non-parametric trend tests were used to assess trends over time.
Results:
In Aboriginal children, the prevalence of ASD with ID (23.3/10,000) was about half that of non- Aboriginal children (45.8/10,000) The prevalence of ASD with ID decreased with increasing levels of remoteness for all children, though the trend was only significant in non-Aboriginal children (possibly due to larger numbers). Over time, there was no evidence of an increasing trend in the prevalence of ASD with ID in Aboriginal children (P-value = 0.75). In contrast, over time, there was a significantly increasing prevalence in non-Aboriginal children (P-value <0.0005).
Conclusions:
Improved diagnostic opportunities for ASD with ID are needed for Aboriginal children and all non-metropolitan children. In addition, a particular focus is needed in Aboriginal children to address the lack of increase over time in this population. With assistance from health-care workers to ensure access, this would enable more children to receive suitable early interventions, other services and funding which would improve children's life opportunities and the Quality of Life of their families.

3:16 **155.004** Feasibility of the Autism Navigator® Training in South Africa

N. J. Chambers[1]*, A. M. Wetherby*[2] *and P. J. de Vries*[3]*, (1)Child and Adolescent Psychiatry, UCT, Cape Town, SOUTH AFRICA, (2)Florida State University Autism Institute, Tallahassee, FL, (3)University of Cape Town, Cape Town, SOUTH AFRICA*

Background: Â Across the globe autism spectrum disorder (ASD) is generally diagnosed long after parents first express concern about their child's development, and long after the age at which red flags can now reliably be identified. To help address this knowledge-practice gap, researchers at Florida State University developed the Autism Navigator® for Primary Care**,** a web-based professional development course with extensive video illustrations of over 2-dozen toddlers 18-24 months of age with ASD and families participating in early screening, diagnosis, and intervention. There are immense training needs in South Africa with respect to all aspects of ASD, including early detection. Time and cost-effective evidence-based training is essential to lower the age of detection of ASD and improve access to services.
Objectives: Â This study examined the feasibility of using the Autism Navigator for Primary Care® course in the Western Cape of South Africa. Professionals who may be the first person a family consults with concerns about their child's development were recruited from a range of sectors including public and private health, public education, autism-specific NGOs, undergraduates, and postgraduate medical students.
Methods: Â Participants were asked to complete Units 1-3 of the course as these were considered to be the most universally applicable in content. Changes in knowledge as well as satisfaction with the content and technology of the training in the South African context were examined using a mixed methods approach. Quantitative data included a researcher-constructed 18-item knowledge scale completed before and after the training and a survey of training variables. The impact of demographic characteristics on these measures was also examined. Qualitative data were collected to determine participants' views on the relevance and feasibility of the training.
Results: Seventy-nine participants gave consent for the training and 61 (77%) completed Units 1-3. Of the completers, 50 (82%) returned the post-training forms. Second language English speakers spent significantly longer completing the built-in learner assessments for all three content units. Lower self-ratings of computer proficiency were also associated with longer time spent in Unit 3. Initial scores on the knowledge instrument were significantly related to level of experience with ASD. The group demonstrated significant improvements in knowledge on this instrument from before to after the training, with smaller changes associated with more experience. Thirty-eight participants took part in group or individual feedback interviews. Comments regarding relevance of the training in their local contexts were very positive. Suggestions for local translations and adaptations were also made. The most commonly mentioned benefit of the training was the extensive library of videos to illustrate red flags. Barriers to the feasibility included length of the training, and technology access barriers.
Conclusions: Results indicate the feasibility of this web-based training in a low-resource setting and suggest that the Autism Navigator for Primary Care® may have valuable potential to improve knowledge of the early flags of ASD in South Africa. Findings highlight the need to consider language and technology demands of the web-based training and knowledge measurement across professionals with differing experience.

Panel Session
156 - Parent/Caregiver Education Training for ASD – What Is the Best Model for Delivery, and How Do We Best Evaluate Outcomes?

3:30 PM - 5:00 PM - Yerba Buena 3-6

Panel Chair: Petrus de Vries*, University of Cape Town, Cape Town, South Africa*

There is consensus that parent education training, often referred to as 'psycho-education', is an essential part of post-diagnostic intervention. However, there is not consensus on the best models to provide these trainings (e.g. duration, frequency, location and providers), or what key 'active ingredients' of parent education training might be. Furthermore, evaluation of parent education training programmes have been limited, and have typically consisted of 'pre-post' satisfaction questionnaires. There is therefore no broad-based evaluation framework to compare programmes, or to determine whether a programme had a positive outcome. In this panel, we present 5 very different parent education programmes to address these issues. In the first presentation, we examine an ultra-brief (1 hour) parent education training performed in a community setting in Tanzania. In the second and third presentations, we explore two programmes from India – a two-week inpatient and a 12-15 week non-residential group programme. Finally, we present an implementation science approach to two programmes evaluated in South Africa, one a 12-week widely-used, highly manualized programme from the UK (Early Bird/Early Bird plus), the other a locally-developed, one-week, non-residential outpatient programme. We aim to have a critical discussion to guide the development, evaluation and sustainable implementation of parent education training across the globe.

3:30 **156.001** Examining a Brief Intervention for Parents of Children with Autism in Global Contexts with Limited Resources

A. J. Harrison[1], *K. Long*[2], *K. P. Manji*[3], *K. K. Blane*[4] *and M. S. Kaff*[5], *(1)University of Georgia, Athens, GA, (2)Boston University, Boston, MA, (3)Muhimbili University, Dar Es Salaam, Tanzania, United Republic of, (4)Alpert Medical School of Brown University, East Providence, RI, (5)Special education, Kansas State University, Manhattan, KS*

Background:
Despite the global presence of Autism Spectrum Disorders (ASD), a paucity of treatment services exists in Tanzania and many other low- and middle-income countries. Two primary barriers to accessing ASD treatments in Tanzania include a lack of non-English manualized interventions and treatment providers who can deliver interventions in Swahili. Thus, developing feasible, sustainable methods to offer empirically-based interventions to Tanzanian children with ASD is a public health priority.
Objectives:
The aim of this study was to address these two primary barriers through the development of a very brief parent-based behavioral intervention protocol that can be feasibly delivered via an interpreter. This talk will (1) describe the development this intervention designed to introduce parents to general behavior modification strategies, (2) reports on the initial feasibility and acceptability of a pilot trial in Tanzania, and (3) examines the generalization of this intervention to a different cultural context.
Methods: Study development and pilot testing occurred in Tanzania in two phases. Twelve caregivers of children with ASD and other developmental disabilities (DD) participated in the initial intervention development phase. The intervention was tailored to meet collaboratively set goals. In the second phase of the study, the intervention was piloted among 29 caregivers of children with ASD and DD. Parents received a subset of nine brief behavior modification lessons in areas of general parent training and teaching self-help skills. Parents were provided verbal didactics (via an interpreter), handouts in Swahili with visuals depicting strategies, and therapist-modeling. To examine the generalizability of this approach data collection is ongoing to examine the implementation of the intervention in Mongolia.
Results:
In support of the feasibility of use among Swahili-speaking Tanzanians, all 29 caregivers approached agreed to participate in the study. Despite cultural, language, and logistical barriers, 86% of parents reported that the intervention was helpful, with the remainder of parents requesting more comprehensive training. Families received training in one to six (M=4.16, SD=1.53) of the behavioral modules depending on the treatment goals determined collaboratively between the clinician and caregiver. Those delivered most frequently included “Using Reinforcement Strategies” (86%), “Teaching Requesting” (71%), “Increasing Eye Contact” (65%), “Following Directions” (48%), “Imitating” (48%), and “Toileting” (45%). We examined differences in the number of modules administered to children with ASD as compared to children with DD and found no group difference, $t(26)=.82$, $p=.42$, thus indicating that the intervention modules were relevant for both diagnostic groups.
Conclusions: Teaching parents to implement basic behavioral principles may ameliorate functional impairments among Tanzanian children with ASD. Results from the pilot intervention support the feasibility of future use among Swahili speaking Tanzanians. Implications of this pilot extend to non-English families in the U.S. who are also in need of brief interventions to teach basic behavioral techniques. This approach will help to improve functional outcomes among children with ASD and reduce ASD disparities both locally and globally. In the discussion, we also will examine how this intervention generalizes to another global context, Mongolia, where intervention implementation and data collection is underway.

3:50 **156.002** The Impact of a Two-Week in-Patient Parent Training for Autism Spectrum Disorder in India

P. K. Panchal*, Department of Child & Adolescent Psychiatry, National Institute of Mental Health and Neurosciences, Bangalore, India*

Background:
The benefits of parent training for Autism Spectrum Disorder (ASD) on the child and family outcome are well proven. Most parent training interventions are similar in content but differ in the service delivery model. The present study was conducted at a tertiary child psychiatry centre in India. Most families seeking treatment at the centre belong to middle socio-economic status, are non-local residents, have poor understanding about their child’s problems, and lack resources locally. Majority of the children receive diagnosis of ASD for the first time at the tertiary centre, and are also diagnosed with multiple co-morbid disorders. Present study was conducted to assess the effect of brief parent training for ASD during the hospital admission.
Objectives:
To assess the impact of a two-week in-patient parent training for home based interventions for ASD on the parents.
Methods:
The sample consisted of families of twenty children between the ages of 3- 10 years, diagnosed of ASD and admitted in the centre. Baseline measures included Childhood Autism Rating Scale 2nd edition (CARS-2), Vineland Social Maturity Scale (VSMS), FISC-ASD (Family Interview for Stress and Coping -ASD), Autism Parenting Stress Index (APSI) and Autism Treatment Evaluation Checklist (ATEC). Parents received daily individualised sessions focusing on psycho-education, skills training, management of problem behaviour and alleviation of family stress. Parents were re-evaluated post intervention using ATEC, APSI and FISC-ASD. The FISC-ASD is a locally-developed, semi-structured tool. It has two sections: perceived stress and mediators of stress. Higher scores in section 1 and 2 mean higher family stress and lower awareness respectively. Parents were also asked to rate their experience of the intervention at the end through a feedback form.
Results: A total of thirty five caregivers (nineteen mothers, fourteen fathers and two grandparents) received the intervention. All the families were residents of other Indian States. Mean duration of stay was 15.5 ± 4.3 days. Mean age of children was 59.4 months (SD-21.8). Mean baseline scores were CARS-2 – 34.9 (SD-4.2), VSMS- 55.3 (SD-1.6), ATEC- 93.2 (SD-20.0) and APSI- 21.8 (SD-10.4). There was statistically significant improvement in the ATEC, APSI and FISC-ASD section on mediators of stress post intervention. There was no statistically significant change in the FISC-ASD section on perceived stress. There was no statistically significant correlation between pre-post scores of ATEC, APSI and FISC-ASD (mediators of stress). Eighty percent families reported that the training was very helpful to them.
Conclusions: Â A two week hospital admission helped to reduce parental stress, improve knowledge and child rearing practices of families across the socio-economic background. Majority of the parents perceived the training as very helpful. The main limitation of study was lack of a blind independent rater and matched control group. We propose that this in-patient service model is useful in a multidisciplinary, specialist setting where it may allow sufficient time to address the multiple issues (co morbid conditions, problem behaviour, poor parental knowledge) faced by the families and children with ASD.

4:10 **156.003** Parent Acceptance and Empowerment Training MODEL: Evidence from a Parent Training Intervention for ASD in New Delhi, India

N. Singhal[1], ***M. Barua***[1], *T. C. Daley*[2], *R. S. Brezis*[3] *and T. Weisner*[4], *(1)Action For Autism, New Delhi, INDIA, (2)Westat, Durham, NC, (3)Interdisciplinary Center, Herzliya, ISRAEL, (4)UCLA, Los Angeles, CA*

Background: The Parent Child Training Program (PCTP) was developed at Action For India, New Delhi, India in 2000 with acceptance of the child and empowerment of the parents as explicit program goals. The program additionally provides practical and theoretical knowledge on autism and behavior management. Training takes place with a group of approximately 12-15 families, thrice every year, over a 3-month period, with the parent and child attending together for 4 hours a day, five days a week. The training includes daily group and one-on-one activities with the children, and group discussions for the parents. To date, the PCTP has trained over 500 families from more than 20 Indian states and eight different countries. The program has been replicated in at least 15 different cities in three different countries.
Objectives: The purpose of the current study was to examine the effectiveness of the programme by focusing on mothers' empowerment and acceptance towards the child; and the extent to which parenting skills acquired through the training transfer to the home setting and are maintained over time.
Methods: Three consecutive cohorts of families (*n*=48 total) participated in the evaluation. Participants joined from a wait-list and entered on a first-come, first-served basis. Diagnosis was confirmed using the ADOS and SCQ. Both parents were interviewed at the start and end of the 3-month program and mothers attended the program. Parents and children were followed eight and 15 months after the conclusion of the PCTP program. Measures consisted of a combination of standardized tools and those developed specifically for this evaluation under a broader project on research on families with autism in India.
Results: Cohorts did not differ in demographic characteristics or baseline outcome measures. Significant gains were seen across all outcome measures, including parents' acceptance, empowerment, knowledge of autism, sense of competence, and stress from before to after the program. These gains were further maintained 15 months later.
Conclusions: The PCTP was developed specifically to meet the needs of families in India, where disability remains highly stigmatizing and services are limited. Using both standardized measures and those developed for this study, the current evaluation provides an estimate of project impacts in key parent outcomes. The fact that parents maintained their gains in acceptance and empowerment 15 months after the end of the program provides compelling evidence for the program's success and generalizability. The acceptance and empowerment focus of this model offers a novel way to conceptualize parent training, and has high relevance for families in situations where cultural, economic and other contextual factors may be similar to those in India.

4:30 **156.004** An Implementation Science Approach to Parent Education Training – Generation of an Evaluation Framework and Comparison of Two Programmes in a South African Setting

***J. J. Dawson-Squibb**, Division of Child & Adolescent Psychiatry, University of Cape Town, Cape Town, South Africa*

Background:
Parent Education Training (PET) is increasingly considered an important component of early treatment for Autism Spectrum Disorders (ASD). It covers a range of modalities and different PET programmes employ different approaches and goals. Ensuring these are contextually appropriate to stakeholders, including parents, is critical for effectiveness, sustainability and future scale-up. While there is growing research in this area, little comparison of different PET programmes has been attempted. Particularly in Low- and Middle Income Countries (LMIC), where financial restrictions are pervasive, selecting programmes that meet the needs of relevant stakeholders is paramount.
Objectives:
We set out to generate an evaluation framework for parent education training using a stakeholder participatory strategy, and then ran two different programmes for comparison using the agreed evaluation framework.
Methods:
The study used a consecutive, mixed-methods design. Given the absence of any universally-agreed tools to compare PET programmes, an evaluation framework was generated by a panel of 13 stakeholders. Stakeholders were recruited via consensus sampling and had knowledge and experience in the area of ASD while working in LMIC. Consensus discussion in groups was used to generate a final evaluation framework.
Two PET programmes were selected for head-to-head feasibility evaluation. Autism Cares is a locally-developed 5-day outpatient programme; EarlyBird is a well-established, manualised 12-week programme developed by the U.K.'s National Autistic Society. With ethics approvals, families were recruited to participate in a pilot feasibility study via a local not-for-profit ASD organisation. Semi-structured pre and post-interviews with the parents participating in the programmes were conducted, focusing on feasibility. In addition, a quasi-experimental pre-post design was used to assess outcomes in multiple areas, including knowledge of ASD, confidence, parental stress, and functioning of the child using standardised questionnaires. A waiting list group were used as control for the two active groups.
Results:
The consensus evaluation framework set out three core areas deemed relevant and important to PET programmes - Outcomes, Process and Implementation. 'Outcomes' related to changes in parent including knowledge of ASD and emotional well-being. In addition, changes in child well-being and family functioning were determined to be important features of PET goals. 'Process' included the acceptability and accessibility of the programme. 'Implementation' priority evaluation areas included sustainability, scalability and integration between systems and organisations.
11 families participated in the EB/EB+ programmes and 10 in Autism Cares,all completed the programmes. Participant ages ranged from 26 to 57 years and monthly household income ranged from less than $360 to between $1800-$7200. Qualitative post programme feedback from participants was very positive for both EB/EB+ and Autism Cares.
Here we will present the head-to-head comparison of findings in context of the consensus evaluation framework.
Conclusions:
Depite the acknowledged value of parent education training, there hasn't been consensus on an evaluation framework for the range of PET that are delivered around the globe. Our implementation science study suggested that, whilst efficacy is an important pre-requisite for potential use, many other factors may have to be considered to determine the most suitable programmes for successful implementation and scale-up in local communities.

Panel Session
157 - Addressing Disparities through Interventions in Diverse Community Systems
3:30 PM - 5:00 PM - Yerba Buena 7

Panel Chair: Laura Anthony, *Children's National Health System, Washington, DC*

Discussant: Connie Kasari, *University of California, Los Angeles, Los Angeles, CA*

Despite increases in awareness of ASD, there remain vast disparities in community-based screening, diagnosis, acceptance, inclusion, and access to evidence-based care. This panel will present findings from four very different community-based intervention projects; online resources to increase acceptance and reduce bias, a stakeholder informed primary care program to increase the rate of screening and referral for young Latino children; a school-based comparative effectiveness trial addressing executive function in low-income schools; and a program to increase the use of evidence-based practices in publically-funded mental health centers. Though the studies presented take place in very different community contexts, they share common goals of addressing disparities, using intensive stakeholder input and community partnerships for successful adaptations, and sustainability through using existing community-based systems and the staff who already work there. These projects and researchers also share common lessons learned, such as the amount of time that must be dedicated to building trusting relationships before making changes in disenfranchised communities, the need for creative and adaptive

methodologies, that crucial stakeholder input must include individuals with ASD, their families and those in the community service systems, as well as the need for very specialized adaptations for each community and setting.

3:30 **157.001** Impact of a Supported Screening Program to Increase Identification and Assessment of Latino Children at Risk for ASD

B. J. Anthony[1], *K. Linas*[1], *M. Biel*[2], *R. Mendez*[1], *S. C. Dos Santos-Arquinio*[1] *and D. Jacobstein*[1], *(1)Center for Child and Human Development, Georgetown University, Washington, DC, (2)Georgetown University, Washington, DC*

Background:
Screening in primary care is an important step in identifying young children with ASDs, expediting early behavioral and educational interventions. However, despite evidence that formal screening improves accuracy of identification over informal clinical assessment, there is far from universal use of ASD-specific screening tools with use is lower still with Spanish-speaking patient populations. Moreover, there continues to be strong evidence of disparities in identification, age at the time of initial diagnosis, referral, and treatment for Latino children compared to non-Latino white. Here, we present evidence for the effectiveness of an 18-month trial of *Supported Screening (SS)*—developed and implemented through a community participatory process to enhance the uptake of universal screening for ASDs in a large primary care center serving a primarily Latino population and increase identification and further assessment of children with ASD.
Objectives:
The goals of *SS* are to enhance the identification of ASDs and other developmental delays in Latino children by increasing: (1) screenings conducted at 18- and 24-month well-child visits; (2) positive screens; and (3) successful referrals and timely evaluations.
Methods:
SS was implemented at a large Federally Qualified Health Center serving a primarily urban Latino population in Washington, D.C and involved formative research with families, primary care providers (PCPs) and staff to inform: (1) family outreach activities and resources*;* (2) practice-wide training for PCPs and staff, and (3) services of Family Navigators (FN) with lived experience who provided support to families with a child identified at risk for ASD as well as ongoing care coordination with early intervention and medical providers. Screens and referrals were tracked for the approximately 7000 0-36 month old children per year, 70% of whom were identified as Latino.
Results:
Formative research, including cognitive interviewing, resulted in adaptation of M-CHAT and its administration (verbal, combined screening and follow-up, implementation by FNs and PCPs) and comprehensive training emphasizing engaging families/addressing barriers, coupled with available consultation. Training resulted significant increases in staff knowledge of autism, screening and factors that increase caregiver disclosure of developmental concerns. The percentage of children screened rose from under 10% prior to the onset of SS to almost 90%. PCPs completed only a small number of screens at the onset of SS but almost 50% by the end. Records indicated that no children were identified at risk for ASD in the year prior to SS; however, by the end of the trail 4% of eligible children screened positively on the M-CHAT and were referred for services, a rate comparable to those found in other Spanish language populations.
Conclusions:
Universal screening for ASDs in a center serving predominantly Latino families and successful follow-up of positive screens was facilitated by assessment of community/provider needs, increased staff skills in culturally appropriate family engagement, screening, and referral, and FNs integrated into the health provider system. Attention to these issues increase disclosure of developmental concerns by Latino families, produced improved attitudes of providers and families toward early screening and referral for ASDs, helping to reduce disparities in rates of diagnosis and treatment.

3:50 **157.002** Addressing Disparities By Reducing Stigma and Increasing Acceptance?: Sesame Street's See Amazing in All Children Online Initiative

L. G. Anthony[1], *H. A. Robertson*[2], *S. Seese*[1], *A. D. Verbalis*[1], *C. Domitrovich*[2], *C. L. Dickter*[3], *J. Burk*[3] *and B. J. Anthony*[4], *(1)Children's National Health System, Washington, DC, (2)Georgetown University, Washington, DC, (3)College of William & Mary, Williamsburg, VA, (4)Center for Child and Human Development, Georgetown University, Washington, DC*

Background:
While the diagnosis of ASD is common (CDC, 2016), poor understanding of the condition contributes to diagnostic and treatment disparities, discrimination, verbal abuse, and even physical violence (Sterzing et al., 2012). To help address this lack of awareness and acceptance, Sesame Workshop created “See Amazing in All Children.” This on-line, nationwide initiative, developed with input from parents, people who serve the autism community, and autistic people, includes video stories, an electronic storybook and routine cards for parents to use to help their kids with daily routines and life skills. These free resources offer all families ways to overcome common challenges and simplify everyday activities while fostering an affirming narrative around autism for all families and kids.
Objectives:
To assess the impact of the See Amazing in All Children initiative on parents of young children with autism by measuring knowledge, attitudes and biases towards children with autism, parenting competence, empowerment, and engagement with the community prior to (PRE) and after (POST) reviewing the initiative materials. A parallel study will collect similar data from a community sample.
Methods:
Parents review the materials and complete the PRE and POST evaluations on line. We expect to recruit at least 150 parents of preschoolers with ASD, 100 of those with both PRE and POST data. Here we report preliminary results; analyses of PRE data from 72 parents and PRE and POST data from 20 parents. The evaluation survey included:

- Detailed demographics (including gender, race/ethnicity, income, education displayed in table 1)
- Previous contact with the materials
- The *Social Communication Questionnaire* (Rutter, Bailey & Lord, 2003) to confirm diagnosis
- An Implicit Association Test to assess implicit bias, or hidden thoughts and feelings outside of conscious awareness and control, towards young children with autism
- Explicit attitudes and beliefs about autism through questions related to a short video of a child with ASD
- Parent knowledge about ASD, strain, competence and community inclusion/stigma/advocacy.

After PRE, participants are asked to view the *See Amazing in All Children* videos and other web content. Follow-up data is collected at 1 week and 1 month intervals after the parent reviews the materials.
Results:
Preliminary findings indicate strong associations among parents’ explicit attitudes and beliefs, total knowledge about ASD, stigma, and community inclusion. Implicit bias did not relate to other measures. See table 2 for findings. Preliminary pre-post data suggests improvements in knowledge will be evident at the one week time point. We hypothesize that the increase in knowledge gained from interacting with the See Amazing materials, and the positive and empowering nature of the materials, will result in a decreased sense of stigma, increased feelings of competence and empowerment, and a more positive attitude resulting in fewer biases.
Conclusions: Sesame Street, with its broad reach and positive messaging, is uniquely positioned to directly target parental and community knowledge and attitudes around ASD. The results of this study will not only tell us whether the Muppets are successful in their endeavor, but will provide insight into the factors that contribute to biases and stigma.

4:10 **157.003** Provider and Caregiver Perspectives on Disparities in the Delivery of Evidence-Based Strategies in Publicly-Funded Mental Health Services: Implications for Intervention and Provider Training Models

C. Chlebowski[1], *B. Wright*[2], *S. Magana*[3] *and L. Brookman-Frazee*[4], *(1)University of California, San Diego, San Diego, CA, (2)UCLA, Los Angeles, CA, (3)Disability and Human Development, University of Illinois at Chicago, Chicago, IL, (4)University of California, San Diego, La Jolla, CA*

Background: There are well-documented ethnic/racial disparities in access to and quality of community services for children with ASD. It is not known, however, if disparities persist when providers are trained to deliver evidence-based (EB) interventions. Understanding the role of cultural factors associated with treatment process when providers are delivering EB interventions is critical to tailoring interventions to fit the needs of client receiving care in community services.
Objectives: Gather community provider and caregiver perspectives to characterize disparities in delivery of mental health intervention for ASD and identify key adaptations to treatment and provider training protocols.
Methods: Data were collected in the context of a community effectiveness trial of AIM HI, an intervention designed to reduce challenging behaviors in the context of mental health services. Qualitative data were collected to complement and expand findings from the parent study. Participants included a subset of individuals enrolled in the effectiveness trial, including 17 therapists who participated in AIM HI training and 29 Hispanic caregivers (66% who speak Spanish as their primary language) whose child received mental health care from therapists trained in AIM HI. Data were obtained from the following sources: 1) therapist focus groups and individual interviews and 2) caregiver interviews.
Results: Themes regarding provider and caregiver perspectives were consistent with quantitative findings from observational session data from the parent study indicating few differences in treatment process by caregiver ethnicity. Qualitative data expanded to indicate that differences in treatment process were primarily related to client and caregiver education and social economic status (SES). The following factors were identified as influencing treatment process by therapists: (1) level of caregiver mental health literacy, including expectation regarding caregiver involvement; (2) caregiver understanding of ASD and its impact on child behaviors; (3) Caregiver primary language, including the complexity of conducting treatment through a translator or application of behavioral terminology when sessions were conducted in Spanish; (4) The cultural factors including the value of *respeto* and caregiver deference to providers, the influence of extended family members expectations of treatment, stigma, and the alignment of parenting values and a behavioral approach. Themes from caregiver interviews highlighted pragmatic variables influencing treatment, including logistics and time required to complete session activities and between session practice. Therapists also identified adaptations to the clinical intervention and therapist training l to address differences in treatment process including (1) changing the pacing of intervention to leave time for psychoeducation regarding ASD, (2) modifying materials to reduce technical terminology and increase “parent friendly” language to support understanding and home practice, and (3) explicit attention to new areas during AIM HI training, including how to deliver AIM HI with translators, key areas of psychoeducation, and incorporating cultural values in collaborative process with parents and identification of behavioral strategies.
Conclusions: This study was conducted as part of a broader line of research using community partnered approaches to intervention development and refinement. Results illustrate key issues that may influences disparities in treatment process and feasible adaptations to ensure the fit of interventions to families served in publically–funded mental health settings.

4:30 **157.004** Differential Outcomes in an Addressing Disparities Comparative Effectiveness Trial of Community-Based Executive Function Treatments in ASD and ADHD

L. Kenworthy[1], *L. G. Anthony*[1], *K. Hardy*[1], *J. Safer-Lichtenstein*[2], *A. D. Verbalis*[1], *M. Biel*[3], *S. Seese*[1], *J. F. Strang*[1], *A. B. Ratto*[4], *C. E. Pugliese*[4], *C. K. Kraper*[1], *J. L. Martucci*[1], *M. C. Wills*[4], *C. Luong-Tran*[5], *L. Cannon*[6], *A. C. Sharber*[5] *and B. J. Anthony*[2], *(1)Children's National Health System, Washington, DC, (2)Center for Child and Human Development, Georgetown University, Washington, DC, (3)Georgetown University, Washington, DC, (4)Children's National Medical Center, Washington, DC, (5)Children's National Medical System, Washington, DC, (6)Ivymount School, Rockville, MD*

Background: Economic disparities in access to diagnosis and treatment are prominent in ASD and in ADHD. Both disorders are strongly associated with executive dysfunction, which is itself also an outcome of child poverty. Contingency behavioral management (CBM) is currently considered to be standard care for children with ADHD to treat EF related problems in schools. Unstuck and on Target (UOT) is a cognitive-behavioral executive function (flexibility, goal-setting and planning) intervention, which we found to be effective in middle-income children with ASD (Kenworthy & Anthony et al., 2014). Unlike other cognitive-behavioral treatments, UOT is implemented in school instead of a clinic, making it low cost, accessible and more likely to generalize to real world settings. We adapted UOT and CBM for use with low income and minority families (in either English or Spanish) and children with ASD or ADHD. We developed the CBM intervention, called Parents and Teachers Supporting Students (PATSS) to be accessible/empowering to the students, parents and teachers (e.g. terminology adjusted—"antecedent" changed to "trigger; students participated in the development of their behavior goals), and to specifically target flexibility and other EF problems.
Objectives: Compare the effectiveness of two EF treatments, UOT and PATSS, in typically underserved children with ASD or ADHD and flexibility problems.
Methods: The interventions were embedded in 22 mainstream Title 1 elementary schools in which at least half of the students qualify for free/reduced lunch fees. All children: had IQ>70; were in 3rd-5thgrade; were identified by school staff as being inflexible and having characteristics of ADHD or ASD; and met diagnostic criteria for either ASD (ADOS-2) or ADHD (MINIKid). 145 children (ASD n=48; ADHD n=97) completed the trial. Of those that completed the trial, only 29.7% were White/Non-Hispanic. The intervention groups were equivalent regarding age, sex, and IQ. Both interventions were delivered by school staff to small groups of students in approximately 20 sessions of 30-40 minutes each. The two interventions were matched for amount of parent, teacher and interventionist training (70% of parents attended a parent training). We compared change in both groups from pre- to post-intervention (PRE, POST) via treatment blinded classroom observations, classroom teacher ratings (SKAMP), WASI Block Design and BRIEF scores.
Results: Fidelity ratings were adequate overall. Performance on all measures improved for both ASD and ADHD children following UOT, but PATSS demonstrated more differentiated effects with more improvements in ADHD. See Table below for paired samples t-tests. Blinded classroom observations also showed some important differential effects in specific behavioral targets. See Figure below for percentages of children who improved on each of the classroom behaviors observed.
Conclusions: Children with ASD and ADHD in low-income schools benefit from community-based EF interventions adapted to engage teachers and families.

Panel Session
158 - Developing Clinically Practicable Biomarkers for Autism Spectrum Disorder
3:30 PM - 5:00 PM - Yerba Buena 8

Panel Chair: James McPartland, *Yale School of Medicine, New Haven, CT*

Discussant: James McPartland, *Child Study Center, Yale School of Medicine, New Haven, CT*

Despite significant advances in understanding the biological bases of autism spectrum disorder (ASD), the field remains primarily reliant on observational and parent-report measures of behavior to guide clinical practice, conduct research, and evaluate intervention outcomes. There is a critical need for objective measures to more sensitively and validly quantify risk for ASD, ASD symptomatology, and its change in clinical trials. To maximize public health impact, such biomarkers must be cost-effective and utilize accessible and scalable technologies. This panel brings together five autism research centers, with panelists spanning early career faculty to senior leaders in the field. The biomarkers presented for study all rely on accessible and economical technologies. Three studies will be presented to highlight promising biomarker modalities that can be implemented feasibly in large clinical trials: electroencephalography (EEG), eye-tracking, and wearable autonomic sensors. A fourth study presents data integrating these modalities to provide unique composite information in the context of an ASD clinical trial. Discussion will focus on unique concerns for the development of biomarkers that can facilitate prediction of outcome and diagnostic stratification and on approaches to optimize understanding of these biomarkers through development of large-scale consortia and clinical networks.

3:30 **158.001** Early Electrophysiological Biomarkers of Risk for ASD: Insights Gained from Studies of Infant Siblings and Tuberous Sclerosis Complex

S. S. Jeste[1], *K. J. Varcin*[2], *A. Dickinson*[3], *J. Frohlich*[3], *M. Dapretto*[3] *and C. A. Nelson*[4], *(1)UCLA, Los Angeles, CA, (2)Telethon Kids Institute, Perth, Australia, (3)University of California, Los Angeles, Los Angeles, CA, (4)Boston Children's Hospital, Boston, MA*

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Background: A variety of genetic and environmental factors contribute to the heterogeneity of autism spectrum disorders (ASD). However, across etiologies, the underlying neurobiology of ASD converges on the regulation of fundamental processes of brain development such as cortical organization, synapse structure and function, and intra-cortical connectivity. These processes can be measured through methods such as electroencephalography (EEG) before behavioral signs of atypical development emerge. The investigation of infants at heightened genetic risk for ASD affords us an opportunity to examine early biomarkers of risk. Such investigations can shed light on mechanisms underlying atypical development.
Objectives: We present data from two studies of biomarkers of risk for ASD: (1) a study of infants with an older sibling with ASD ("infant siblings") and (2) a multisite study of infants with Tuberous Sclerosis Complex (TSC). We asked whether there were common and distinct biomarkers of risk across and within groups.
Methods: Infants in each study were tested longitudinally, the infant siblings (n=35 LR, n=47 HR) beginning at age 3 months and the infants with TSC (n=18 LR, n=40 TSC) beginning at age 6 months. Each group was compared to a cohort of "low risk" infants without a known genetic susceptibility for ASD. High density spontaneous EEG was recorded while infants watched abstract, non-social images on a screen. Variables of interest included EEG oscillatory power as a marker of baseline neural synchrony, and frequency variance and whole brain coherence as measures of connectivity and network formation. Cognition and social communication were measured beginning at 6 months of age, with ASD diagnosis made at age 36 months using the Autism Diagnostic Observation Schedule (ADOS) and clinical best estimate.
Results: Distinct trajectories were identified based on risk grouping in spontaneous EEG power, frequency variance, and coherence. More specifically, in the first year of life infants at high risk demonstrated (1) reduced power in alpha (8-11 Hz) [LR: relative power 0.15-0.20 across first year of life, HR: 0.08-0.10, $p<0.01$ at each age] and gamma (35-50 Hz) bands [LR:relative power 0.05-0.06, HR: 0.03-0.04, $p<0.01$ at age 9 and 12 months], with the greatest reduction in alpha power found in infants with TSC who developed ASD [$p=0.003$ at 18 and 24 months] and (2) differences in frequency variance (specifically, greater rate of change in FV in LR infants, $p<0.01$), alpha band coherence (modularity at 3 months lower in HR infants, 0.035 vs 0.040, $p=0.03$) that reflected differences in connectivity and signal complexity. Biomarkers of risk were detectable as early as 3 months in the infant siblings and 6 months in infants with TSC in EEG power and coherence.
Conclusions: The putative neurobiological processes that underlie the development of ASD unfold early in life and precede behavioral signs of atypical development. EEG holds particular promise as a biomarker of risk for both scientific and practical reasons. We consider the methodological, clinical, and ethical implications of pre-behavioral biomarkers of risk and discuss the potential for studies to inform the initiation of early developmental interventions before behavioral signs of ASD emerge.

3:50 **158.002** Eye Tracking As a Spectrum of Biomarkers in Children with ASD

F. Shic[1]*, Q. Wang*[2]*, A. Naples*[2]*, S. Macari*[2] *and K. Chawarska*[2]*, (1)Seattle Children's Research Institute, Seattle, WA, (2)Yale Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Eye tracking has become a core methodology in autism research and is quickly moving towards relevance as a biomarker for ASD. Yet, the power of eye tracking lies not in its quantitative, objective, technical nature, but in the design of appropriate measures and paradigms that can tap into constructs with clinical and mechanistic relevance.
Objectives:
To critically examine, through a series of example studies, a spectrum of eye tracking data metrics, paradigms, and analysis approaches, with the ultimate goal of charting the trajectory of eye tracking as a potential biomarker for ASD.
Methods:
We aim to categorize eye tracking biomarker development efforts in ASD in terms of their (1) intended use; (2) selection of measures; and (3) theoretical approach. Using illustrative data from infants and toddlers on paradigms such as Chawarska et al., 2012 (including subsets of children with ASD (n=206), developmental delay (DD; n=51), children at high risk for autism without autism (HRNA; n=115) and typical development (TD; n=184)) we describe tasks and approaches designed to capture features of autism, describe mechanisms, and fulfill a practical role in early diagnostics or monitoring. We then turn towards a discussion of measures and contrast high-level region-based approaches to data-, computational-, and statistically-driven approaches.
Results:
We show that standard region-of-interest (ROI) based eye-tracking techniques replicate high-level deficits observed in ASD, such as diminished orienting towards social information ($p<.001$). We show that a single paradigm can be flexibly used to explore genetic mechanisms associated with autism (sex-linked differences between girls at high risk for ASD and other groups at 6 months, $p<.06$), to identify early markers of later developing autism (>80% predictive accuracy), and quantify features associated with clinical phenotypes (correlations with autism severity, $p<.05$). We discuss the utility of missing data and the distributional properties of fixations, saccades, and looking time, highlighting the importance of understanding the fundamental nature of eye tracking metrics and the errors that can result from lack of clarity. We show that data-driven methods, computationally-based approaches, and statistical techniques designed to quantify "atypicality" complement high-level approaches and provide additional precision towards our goal of defining "biomarkers" ($p<.01$). Stepping back and examining the field critically, we highlight the disconnect between eye tracking as a research methodology and as a clinical tool. Similarly, we reframe our progress as a field in terms of our goals for a viable biomarker for autism. We point towards cumulative evidence of the field of eye tracking in ASD research as a positive and the power of large data sets and new approaches to provide illumination.
Conclusions:
Eye tracking is a powerful tool that has provided us with a way of quantifying atypical behavior and social preferences in children with ASD. Viewed as a tool with multiple axes of flexibility and a spectrum of forms, it empowers us to make great progress towards identifying viable biomarkers for ASD symptoms and dimensions impacting quality of life. Yet, in order to do so, our research questions must be framed and appropriate methodology brought to bear.

4:10 **158.003** Wearable Sensor-Based Physiological and Physical Activity Biomarkers for Use in Laboratory and Naturalistic Environments to Assess Arousal and Repetitive Motor Movements in Individuals with Autism Spectrum Disorder

M. S. Goodwin*, Northeastern University, Boston, MA*

Background: Despite autism spectrum disorder (ASD) being widely recognized as the fastest growing and most costly neurodevelopmental disorder worldwide, there is no specific biomarker, laboratory test, or behavioral assessment procedure to identify, characterize, or monitor its progression. ASD is defined exclusively by past and present behavior determined from developmental history interviews, parent reporting on current behavior, and structured and semi-structured tasks that involve social interaction between an examiner and a child.
Objectives: Describe wearable sensor-based physiological and physical activity technologies enabling multimodal assessments of autonomic arousal and repetitive motor movements in ASD in both laboratory and naturalistic environments, and review their utility for biobehavioral phenotyping and response to intervention in ASD.
Methods: Ubiquitous and wearable computing is making it possible to capture data in laboratory, clinical, school, and home settings on an unprecedented scale. Coupled with advances in pattern recognition algorithms and large-scale computing, semi-automated measures of physiology and behavior are emerging including wireless sensors for monitoring physiological arousal and wireless 3-axis accelerometers and pattern recognition algorithms that can automate the detection of stereotypical hand flapping and body rocking.
Results: Results from two lines of research will be reported. The first employs wireless measures of autonomic nervous system (ANS) activity and demonstrates that severely affected children with ASD have different cardiovascular response patterns to various psychological, social, and sensory demands, including substantially higher and less variable heart rate (HR) than a typically developing group of age-sex matched peers. Moreover, in a follow-up replication study repeating the same assessment protocol in 43 severely affected children with ASD, 6 distinguishable subgroups within the ASD sample were identified who display normal, high, and extremely high HR, along with unreactive ('stabile') and reactive ('labile') response patterns using time series-based cluster analysis. In the second line of research, wireless 3-axis accelerometers and pattern recognition algorithms are employed as automated measures of stereotypical motor movements (SMM) in six severely affected individuals with ASD. Using five time and frequency domain kinematic features and a C4.5 decision tree classifier, average automated hand flapping and body rocking recognition rates of 89.5% in the laboratory and 88.6% in the classroom were achieved. Moreover, a direct replication wherein the same six individuals with ASD were observed three years later in their classrooms while wearing 3, 3-axis accelerometers to determine whether previously trained sensor-based classifiers maintain accuracy over time will be reported. Comparing automated recognition results for two different classifiers – Support Vector Machine and Decision Tree – using our previously established feature set yielded average accuracy across all participants over time ranging from 81.2% to 99.1% for all combinations of classifiers and features.
Conclusions: Identifying more objective and automated physiological and physical activity measures has the potential to transform our ability to better understand the pathophysiology of autism, enhance gold-standard assessments of ASD, aid in subtype identification, individualize treatment protocols, monitor treatment efficacy, and track developmental outcomes.

4:30 **158.004** Use of Biomarkers to Assess Outcomes in a Phase 1 Open Label Trial of Autologous Cord Blood in Young Children with Autism Spectrum Disorder

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Background:
Umbilical cord blood (UCB) may facilitate neural cell protection/repair and reduce inflammation, resulting in improved social communication in children with autism spectrum disorder (ASD). We performed a phase I, open-label study of a single intravenous infusion of autologous UCB in young children with ASD and explored whether behavioral measures and neurophysiologic/imaging biomarkers could be utilized in a future Phase II, randomized trial.
Objectives:
To evaluate the safety of autologous UCB infusion and assess the feasibility and sensitivity to change of several validated behavioral outcome measures and eye-tracking and brain-based biomarkers in a Phase I clinical trial.
Methods:
We treated 25 children with ASD, 24-72 months of age. Diagnosis was based on ADOS-2 and ADI-R, and eligibility required a qualified banked autologous UCB unit. Participants were assessed at baseline, 6, and 12 months post-infusion with the Vineland Adaptive Behavior Scales-II (VABS), Clinical Global Impression (CGI), Pervasive Developmental Disorder Behavior Inventory (PDDBI; also at 3 months), and Expressive One Word Picture Vocabulary Test (EOWPVT). The eye tracking task was a dynamic video that included an actress making joint attention bids (ET; Regions: actress, eyes, mouth and face). MRI with DTI and EEG while viewing dynamic social and nonsocial stimuli were conducted. Adverse events were monitored. Statistical significance of change on VABS, CGI, and EOWPVT was evaluated using the Wilcoxon signed-rank test. A linear spline was fit for the PDDBI, and ET was analyzed using logit-link generalized estimating equations.
Results:
We observed improvements on the VABS socialization (median=2 points; range: -8, 30; P=0.016) and communication (median=4.5; range: -8.0, 20; P=0.002) standard scores, and the CGI-I indicated improvement on 13 patients (52%) from baseline to 6-months (P = 0.001). The PDD-BI Autism Composite, reflecting ASD symptoms, declined in the first 3 months (mean=7.52, 95% CI: -12.38,-2.67; P=0.004). A median change of 4 was observed on the EOWPVT from baseline to 6 months (range: -1, 24) and 5.5 points from 6-12 months (range: -12, 16) (P < 0.01 for both). A 20% increase in odds of gazing at the eyes over time was observed (odds ratio=1.20, 95% CI: 1.00, 1.43, P=0.048). A 7 point change in socialization standard score was associated with a 14% increase in odds of gazing at the actress (OR=1.14, 95% CI: 1.07, 1.21; P < 0.001). Changes in MRI fractional anisotropy were observed but were not significantly associated with the VABS socialization standard score (P = .067). Preliminary analysis of EEG showed significant increases in occipital alpha spectral power over time but no change in other anatomical brain regions. UCB infusion was well tolerated with no serious adverse events reported. Changes in outcomes were unrelated to number of hours of behavioral therapy outside the trial.
Conclusions:
Validated behavioral outcome measures and eye-tracking and neurophysiologic biomarkers were sensitive to change over a six-month period in an open-label study of the safety and feasibility of UCB infusion for ASD. These measures will be used in a larger, double-blind randomized trial investigating efficacy of UCB for reducing core symptoms of autism.

Panel Session
159 - Abnormalities of Neuronal Migration in Autism Spectrum Disorder
3:30 PM - 5:00 PM - Yerba Buena 9

Panel Chair: Manuel Casanova, *Greenville Campus Greenville Health Systems, University of South Carolina School of Medicine, Greenville, SC*

This panel will present tombstones of migratory abnormalities in the brains of ASD individuals. First, neuroimaging techniques have found a blurring of the gray/white matter junction. The blurring is the result of a migratory defect where cells going to the cerebral cortex get stuck in the subplate region. Second, we will explore the neuropathology of corpus callosum abnormalities in order to indicate that axonal guidance defects are closely related to abnormalities of neuronal migration, e.g., heterotopias, an increase in subpial neurons, and cortical malformations. These neuropathological findings have been reported in a significant number of ASD individuals. Third, diffusion tensor imaging (DTI) of the cerebral cortex of ASD individuals have shown abnormalities in diffusivity that correspond to minicolumnar disorganization. Lastly, during corticogenesis radially migrating neuroblasts interact with tangentially migrating neuroblasts to form physiological dyads. In ASD an apparent heterochonic migration of radial cells results in anomalous cellular dyads and a relative reduction of interneurons. The findings presented in this panel indicate that ASD is a neurodevelopmental disorder. The large variety of mechanisms involved in cellular migration as well as large time span that this process occupies during brain development may help explain some of the clinical heterogeneity observed in ASD.

3:30 **159.001** In Vivo Evidence of Reduced Integrity of the Grey-White Matter Boundary in Autism Spectrum Disorder

D. Andrews[1], *T. A. Avino*[2], *M. Gudbrandsen*[1], *E. Daly*[1], *A. Marquand*[3,4], *C. M. Murphy*[1,5], *M. C. Lai*[6,7,8], *M. V. Lombardo*[6,9], *A. N. Ruigrok*[6], *S. C. Williams*[4], *E. Bullmore*[10], *J. Suckling*[10], *S. Baron-Cohen*[6], *M. C. Craig*[1,5], *D. G. Murphy*[1,5] *and C. Ecker*[1,11], *(1)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Psychiatry & Behavioral Sciences, University of California, Davis, MIND Institute, Sacramento, CA, (3)Donders Institute for Brain, Cognition and Behaviour, Radbound University, Nijmegen, Netherlands, (4)Centre for Neuroimaging Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (5)National Autism Unit, Bethlem Royal Hospital, South London and Maudsley NHS Foundation Trust, London, United Kingdom, (6)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (7)Child and Youth Mental Health Collaborative at the Centre for Addiction and Mental Health and The Hospital for Sick Children, Department of Psychiatry, University of Toronto, Toronto, Canada, (8)Department of Psychiatry, National Taiwan University Hospital and College of Medicine, Taipei, Taiwan, (9)University of Cyprus, Nicosia, Cyprus, (10)Brain Mapping Unit, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (11)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychiatry, Goethe-University Frankfurt am Main, Frankfurt, Germany*

Background: Histology studies have revealed abnormal cell patterning along the boundary between cortical layer VI and underlying white matter in Autism Spectrum Disorder (ASD) (Avino & Hutsler, 2010). These findings may be indicative of potential neural migration deficits in the condition. However, there are no *in vivo* studies that examine these particular features of cortical organization in ASD.
Objectives: The current study sought to replicate previous histology findings using *in vivo* neuroimaging based measures of grey-white matter signal intensity ratios (GWR). As individuals with ASD are thought to have less distinct grey and white matter boundaries we expected to find significant decreases in mean GWR amongst our ASD patients, including brain regions previously indicated by Avino & Hutsler (2010) as having abnormal cell patterning at the grey-white matter interface, namely the superior temporal gyrus, dorsolateral frontal lobe, and dorsal parietal lobe.
Methods: 98 right-handed adults with ASD (49 males & 49 females) and 98 matched typically developing controls (51 males and 47 females) aged 18-42 years were recruited and assessed (ICD-10, ADI-R, & ADOS) at the IoPPN, London, and the ARC, Cambridge. A quantitative T1-mapping MRI protocol (Deoni et al., 2008) was used to derive T1-weighted images. Tessellated cortical surface reconstructions were produced using FreeSurfer software (http://surfer.nmr.mgh.harvard.edu/). Tissue intensities were measured from at intervals from 10 to 60% into the thickness of the cortical ribbon from the pial surface for grey matter (G) and 1 mm subjacent to the grey-white boundary along the surface normal for white matter (W). GWR at each sampling depth was calculated as a percentage of grey to white matter contrast at each vertex (*i*): $100*(W_i-G_i)/0.5*(W_i+G_i)$ (Salat et al. 2009). GWR measures were subsequently smoothed using a 10mm FWHM Gaussian kernel. Vertex-wise statistical analysis of GWR was estimated by regression of a general linear model at each vertex with diagnostic group, sex, and site as categorical fixed-effects factors, and age and full scale IQ as continuous covariates. Corrections for multiple comparisons across the whole brain were performed using 'random field theory' based cluster analysis for non-isotropic images ($p<0.05$) (Worsley et al. 1999).
Results: When co-varing for the effects of biological sex, scanning site, age, and IQ, we found significant decreases in GWR measures in individuals with ASD compared to TD controls (RFT-based cluster-corrected, $p<.05$) in clusters centered on the parahippocampal gyrus (BA 36), fusiform gyrus (BA 20), inferior parietal lobule (BA 40), superior and middle temporal gyri (BA 21), and in the anterior cingulate (BA 32). As expected, these reductions were greatest when tissue intensities were sampled close to grey-white matter interface, which indicates a less distinct grey-white matter boundary in ASD.
Conclusions: Individuals with ASD have reductions in GWR measures in several brain regions across the cortex, which have previously been implicated in ASD. Our findings indicate that the boundary between grey and white matter in these regions is less distinct in ASD, which supports previous histology studies suggesting that ASD is associated with potential neural migration deficits in the brain.

3:50 **159.002** A Deficit of Long-Range Connectivity Due to Corpus Callosum Hypoplasia Is Present in Idiopathic and Syndromic (dup15) Autism

J. Wegiel[1], *W. Kaczmarski*[2], *T. Wisniewski*[3], *W. T. Brown*[4], *K. K. Chadman*[5], *E. London*[6], *K. Nowicki*[3], *I. Kuchna*[6], *S. Y. Ma*[3] *and J. Wegiel*[7], *(1)New York State IBR, Staten Island, NY, (2)Morphometry Laboratory, Institute for Basic Research, Staten Island, NY, (3)New York State Institute for Basic Research in Developmental Disabilities, Staten Island, NY, (4)Institute for Basic Research, Staten Island, NY, (5)New York State Institute for Basic Research, Staten Island, NY, (6)NYS Institute for Basic Research in Developmental Disabilities, Staten Island, NY, (7)NYS IBR, Warren, NJ*

Background: A reduced size of the corpus callosum (CC) is a common feature reported in neuroimaging studies in individuals diagnosed with autism (Minshew 2007, Frazier 2009) suggesting a deficit of long distance connectivity. Postmortem studies of the CC in idiopathic autism confirmed a reduced midsaggital area and explained neuroimaging findings by demonstrating a deficit of the total number of CC axons by 48.4% and axonal numerical density by 37% (Wegiel et al, submitted). We hypothesize that CC hypoplasia is a common marker of congenital abnormalities in autism regardless of disorder etiology.
Objectives: The aim of this postmortem study was to establish the type and topography of structural CC anomalies in individuals with dup(15), to compare patterns of CC pathology in dup(15)/autism and idiopathic autism, and to determine the contribution of this pathology to the deficit of long-distance connectivity and behavioral anomalies in these two groups.
Methods: Based on the results of clinical, genetic and neuropathological evaluations, eight brains of individuals with dup(15) were included in this study. Our preliminary evaluation had confirmed the diagnosis of dup(15) and autism, and revealed a high prevalence of epilepsy, microcephaly, focal defects of neuronal migration and dysplasia (Wegiel et al 2012). The brain hemispheres of eight individuals 5 to 39 years of age diagnosed with dup(15)/autism and 8 age-matched control subjects were fixed with formalin, dehydrated, embedded in polyethylene glycol, and cut into equidistant serial 50-µm thick sections. They were used to estimate the midsaggital area of the corpus callosum and the total number and numerical density of axons in five CC segments determined using Hofer and Frahm (2006) CC segmentation, which reflects the cortical distribution of neurons involved in CC formation and function.
Results: There was microcephaly with 20% less brain weight in dup(15)/autism than in control group (1,094g and 1354 g, respectively). Although the length of the CC was almost identical in these two groups (58 mm and 60 mm, respectively), the midsaggital area was 40% less in dup/15/autism than in control individuals (253 mm^2 and 419 mm^2, respectively). The total number of CC axons was 73% less in dup15/autism than in the control group (22 and 83 million, respectively) whereas the numerical density of axons (N/mm^2) was 52% less in the affected subjects than in control individuals (89,000 and 188,000, respectively). The significant deficit of the number of axons in all five CC segments corresponds to a severe deficiency of long distance connectivity of the prefrontal (segment I), premotor (II), motor (III), primary sensory cortex (IV), and the parietal, temporal and occipital cortex (V) in subjects with dup(15)/autism.
Conclusions: Finding similar patterns of developmental anomalies in dup(15)/autism and idiopathic autism indicate that reduced sizes of the CC are consistent markers of congenital brain defects in both autism with genetic and idiopathic etiologies. The results suggest that dup(15) has a direct contribution to both CC hypoplasia and the autistic phenotype.

4:10 **159.003** Altered Cellular Organisation in the Cerebral Cortex: A New Imaging Measure of Cortical Microstructure to Meet the Challenge of Heterogeneity in Autism

S. Chance[1]*, M. Torso*[2]*, R. McKavanagh*[3]*, M. Ravishankar*[3]*, K. Miller*[2]*, S. Sunaert*[4] *and M. Jenkinson*[2]*, (1)John Radcliffe Hospital, Oxford, Oxfordshire, UNITED KINGDOM, (2)University of Oxford, Oxford, United Kingdom, (3)University of Oxford, Oxford, UNITED KINGDOM, (4)University of Leuven, Leuven, BELGIUM*

Background: The key neuropathological findings include altered cortical minicolumns, reductions in cortical interneurons, cerebellar Purkinje cells and various dysplasias. Several theories attempt to integrate these findings but are challenged by the underlying heterogeneity of this condition. Until now, brain microanatomy has only been assessed in post-mortem or in vitro samples whereas macrostructure and cognition has been assessed in living people. It is desirable to identify a marker of microscopic cortical organisation in the same living populations as studied by cognitive neuropsychology.
Objectives: 3 experiments were conducted to confirm the utility of a new MRI measurement of diffusivity applied to the grey matter of the cerebral cortex.
Methods: The newly developed 'CHIPS' (Cortical High-Intensity Profile Segmentation) software was used to calculate several unique measures by comparing diffusivity data with the minicolumn axis in the cortex, derived from DTI of cortical grey matter.
i) *Post-mortem* MRI was conducted to validate the DTI signal as an index of minicolumn alteration by comparison with histological measurements from the identical region. 6 ASD and 6 TD control brains were studied.The 3T MRI acquisition protocol on formalin-fixed tissue included: Modified spin-echo sequence with 3D segmented-EPI, and Structural 3D balanced steady state free precession (BSSFP) sequence. Semi-automated analysis of minicolumns on histological brain sections was conducted using light microscope digital photomicrographs for comparison with semi-automated CHIPS measurements. Five different cortical regions were examined including prefrontal cortex and primary visual cortex.
ii) *Discovery cohort - in vivo* 7T DTI acquisitions were conducted in Oxford, UK. Data was collected from a final sample of 10 TD individuals and 10 ASD (intellectually able and/or Asperger's). Automated whole brain CHIPS analysis was conducted and a VBM analysis was also performed on the accompanying structural scans.
iii**)** *Test Cohort – in vivo* 3T DTI data from 24 TD controls and 20 ASD participants acquired in Leuven, Belgium. Automated whole brain CHIPS analysis was conducted and a VBM analysis was also performed on the accompanying structural scans.
Results:
i) The post-mortem DTI confirmed the predictions of the model indicating a clear correlation between new minicolumn diffusion measures and histological minicolumn width across both diagnostic groups. Also a significant difference in the minicolumn diffusion angle between TD and ASD in brain regions with wider minicolumns. Both effects were evident in all cortical regions assessed.
ii) The high resolution in vivo DTI found a difference in the components of diffusion which indicated wider minicolumns in ASD yielding clear separation of diagnostic groups for 18/20 participants (90% classification accuracy).
iii) The 3T DTI results found CHIPS cortical diffusivity values yielding clear separation of diagnostic groups for 42/44 participants (95% classification accuracy).
Conclusions: Diffusivity parameters in the cerebral cortex correspond to variation in the minicolumnar organisation of neurons spanning the cortical layers. Minicolumns are more widely spaced in several cortical regions in ASD and this can be detected using novel diffusivity measures. The detection of cortical microstructural changes in ASD using MRI opens the door to possible early assessment in young infants whose symptoms are unclear.

4:30 **159.004** Chandellier Cells Modify the Balance of Excitation/Inhibition in Autism

V. Martinez Cerdeno*, UC Davis, Sacramento, CA*

Background: An interneuron alteration has been proposed as a source for the modified balance of excitation/inhibition in the cerebral cortex in autism. We previously demonstrated a decreased number of parvalbumin (PV)-expressing interneurons in prefrontal cortex in autism. Our most recent data indicates that a specific type of PV-expressing neuron is altered in autism, the Chandellier (Ch) cell. Chandellier cells are interneurons that generate fast-spiking action potentials and synchronize the activity of numerous pyramidal cells through rhythmic inhibition. Chandellier cells innervate the axon initial segment of pyramidal cells – in contrast to the rest of interneuron input that takes place on dendrites. As a consequence, the loss of small numbers of Ch cells could critically alter pyramidal neuron output and impair cerebral cortex function.
Objectives: As discussed in our previous publication investigating PV+ interneurons in the autistic neocortex (Hashemi et al., 2016), the decreased number of PV+ Ch cells we detected in in autism may represent an actual decrease in cell number, on the other hand it may represent an apparent decrease in cell number resulting from reduced PV protein levels in Ch cells. To determine if the number of Ch cells, rather that the expression of PV by Ch cells, is altered in autism, we quantified Ch cartridges in autism and control tissue. If the number of Ch cells is decreased we also expect to find a decrease in the number of Ch cartridges.
Methods: We collected prefrontal BA9, BA46, and BA47 in samples obtained from 10 autism, 10 autism with seizure, and 10 control age-matched cases. The tissue was obtained from the Autism Tissue Program (ATP), currently known as Autism BrainNet, and the UC Davis Medical Center. We cut the tissue and performed immunostaining for GAT1 that clearly labels cartridges. We quantified the number of cartridges in 3 mm wide sections of cortex, and statistically compared data between groups.
Results: Our preliminary data indicate that in area BA 46 there is a decrease in the number of GAT1-cartriges in the autism and the autism with seizure groups when compare to the control group.
Conclusions: Here we demonstrated that both Ch cells and also their terminal axons, the Ch cartridges, are numerically decreased in autism. A decrease in the number of Ch cells could result from different factors including 1) decreased production of Ch cells by precursor cells during prenatal development, 2) increased cell death among Ch cells during development, or 3) altered migration of Ch cells to their final destination in the cerebral cortex. This finding expand our understanding of GABAergic system functioning in the human cerebral cortex in autism, which will impact translational research directed towards providing better treatment paradigms for individuals with autism.

Poster Session
160 - Brain Function (fMRI, fcMRI, MRS, EEG, ERP, MEG) II
5:00 PM - 6:30 PM - Golden Gate Ballroom

1 **160.001** A Functional Connectivity-Based Evaluation of Competing Models of Sex Differentiation and Autism

D. L. Floris[1], *M. C. Lai*[2], *T. Nath*[1], *M. P. Milham*[3] *and A. Di Martino*[1], *(1)NYU Child Study Center, New York, NY, (2)Psychiatry, University of Toronto, Toronto, ON, CANADA, (3)Institute for Pediatric Neuroscience, NY, NY*

Background: Accumulating evidence suggests that mechanisms regulating normative sex differences may be related to etiological mechanisms of autism spectrum disorder (ASD) (Lai et al., 2015). Two models have emerged: 1) the Extreme Male Brain theory (EMB) (Baron-Cohen 2002) suggesting that autism is related to hyper-masculinization, regardless of sex, and 2) the Gender Incoherence theory (GI) suggesting that females with ASD are masculinized, whereas males with ASD are feminized (Bejerot et al., 2012). While these models have been supported by evidence from the cognitive, physiological and brain structural imaging domains, to date no resting-state fMRI (R-fMRI) studies have compared them formally.
Objectives: We aimed to systemically examine whether regions of atypical intrinsic functional properties in ASD overlapped with regions showing normative sex differences.
Methods: We used data from two large previous R-fMRI studies: one showing normative sex differences (males (M)=471; females (F)=357; age=8-85 years; Yan et al., 2013), the other revealing atypical connectivity in males with ASD (neurotypical controls (NT)=403; ASD=360; age range=6-58 years; Di Martino et al., 2014). We examined five R-fMRI measures that have been shown to be affected in ASD (Di Martino et al., 2014) and to have distinct patterns by sex (Yan et al., 2013). These included degree centrality, fractional amplitude of low frequency fluctuations, regional homogeneity, voxel-mirrored homotopic connectivity and posterior cingulate cortex seed-based correlation. Spatial overlap analyses were performed by conjunction analyses of the statistical maps from the above studies. Four pairs of contrasts were examined: ASD>NT & M>F (EMB 1); NT>ASD & F>M (EMB 2); ASD>NT & F>M (GI 1); NT>ASD & M>F (GI 2). To test for significance of overlaps, we computed the null distribution of random spatial overlap via Monte Carlo simulations (5000 iterations) for 500 voxel-level thresholds ranging from p=0.0001 to p=0.05 (Lai et al., 2013). To address confounds related to differing preprocessing pipelines and demographics, secondary analyses were conducted in three different samples by a) aligning the preprocessing pipelines using the Configurable Pipeline For The Analysis of Connectomes, b) adjusting for differences in age using sub-samples (17.5-37 years) and c) replicating results using an independent sex difference sample (M=320; F=422; age range=17-35 years) based on the Brain Genomics Superstruct Project database.
Results: Across all R-fMRI measures, there were consistent and non-random overlaps above the 99th percentile of the null distribution between regions showing normative sex differences and those showing ASD-NT differences. Regions consistent with the EMB model were mainly in the default network (DN) bilaterally. In contrast, regions consistent with the GI model mostly encompassed left somatomotor, ventral attention and posterior auditory systems. Results were confirmed with all secondary analyses.
Conclusions: Here, we provide evidence for both EMB and GI models, both of which vary as a function of the neural system involved. Notably, aspects previously reported in ASD such as hypoconnectivity in the DN and posterior language regions may be regulated by atypical sexual differentiation in males with ASD. Future work is warranted to extend current analyses to females with ASD.

2 **160.002** A Preliminary Magnetic Resonance Spectroscopy Investigation Sex Differences in Gamma-Aminobutyric Acid in Autism Spectrum Disorder

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Background: The right dorsolateral prefrontal cortex (rDLPFC) and the right superior temporal sulcus (rSTS) have been implicated in social processing in autism spectrum disorder (ASD). Moreover, there is growing interest in the role of biological sex in ASD, and evidence to suggest that this might contribute to the heterogeneous nature of ASD. While the etiology of ASD remains unknown, it has been suggested that an imbalance of cortical inhibition/excitation might be associated with some of the neurobiological underpinnings of ASD. Recent research has associated gamma-aminobutyric acid (GABA, a major inhibitory neurotransmitter) concentration with the severity of ASD characteristics.
Objectives: This study uses magnetic resonance spectroscopy (MRS) to investigate sex differences in GABA concentration (mM/L) between adults with ASD and typically developing controls. Further, this study investigates the relationship between GABA concentration at the rDLPFC and rSTS, and traits and characteristics associated with ASD.
Methods: Â GABA was measured as part of a large protocol using a 3T magnetic resonance imaging (MRI) scanner. Voxels were placed at the rDLPFC and rSTS based on the participant's structural MRI. rDLPFC GABA concentration was obtained for 25 participants (9 ASD, 16 NT), and rSTS GABA concentration was obtained for 26 (12 ASD, 14 NT) participants. Data were analyzed using LCModel software.
Results: Â There were no differences in GABA concentration at either of these sites between groups, nor when data were stratified by sex. Following correction for multiple comparisons, there was a significant positive relationship between GABA concentration at the rSTS and social impairment in females with ASD.
Conclusions: Â Although inconsistent with a GABAergic model of autism, these findings provide preliminary support for sex differences in neurochemical mechanisms underlying social cognition in ASD.Â

3 **160.003** Abnormal Functional Activation and Maturation of Ventromedial Prefrontal Cortex and Cerebellum during Temporal Discounting in Adolescents and Adults with Autism Spectrum Disorder: A Cross-Sectional Developmental fMRI Investigation

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Background:
People with autism spectrum disorder (ASD) report having problems with, and avoidance of, decision making and have poor temporal foresight. This may adversely impact on their everyday life, mental health and productivity. However, the neural substrates underlying poor choice behaviour in people with ASD, or its' neurofunctional development from childhood to adulthood, are unknown. Despite evidence of atypical structural brain development in ASD, investigation of functional brain maturation in people with ASD is lacking.
Objectives:
1. To investigate the neural substrates underlying performance on a temporal discounting task in 38 healthy (11 - 35 years old) male adolescents and adults with ASD and 40 age, sex and IQ-matched typically developing healthy controls using fMRI.
2. To assess group differences in the neurofunctional maturation of temporal discounting across childhood and adulthood using cross-sectional fMRI investigation.
Methods:
The fMRI temporal discounting task measures the choice between a small reward that is immediately available or a larger delayed reward and requires both inhibition of immediate reward and temporal foresight (forward thinking/future consideration of current choice).
Seventy eight right handed medication-naive healthy adolescent and adult males with IQ > 70 (N = 38 with non-comorbid ASD and N = 40 age and IQ matched typically developing controls) completed the event related fMRI temporal discounting task on a 3T MRI scanner (General Electric, Milwaukee, USA).
fMRI data analyses compared groups in brain activation and tested for group by age interaction effects using non-parametric fMRI data analyses (XBAM: www.brainmap.co.uk). Correlations were tested between performance measures and ASD severity measures and brain activation differences.
Results:
Males with ASD had significantly poorer task performance and significantly lower brain activation in typical right hemispheric regions that mediate temporal discounting for delayed choices, including right ventrolateral, dorsolateral and ventromedial prefrontal cortices, striato-limbic regions and cerebellum. Importantly, differential activation in ventromedial frontal cortex and cerebellum was associated with abnormal functional brain maturation; controls, in contrast to people with ASD, showed progressively increasing activation with increasing age in these regions; which furthermore was associated with task performance and clinical severity measures of ASD (stereotyped/restricted interests).
Conclusions:
This cross-sectional develomental fMRI investigation provides first evidence that reduced activation in people with ASD of ventromedial frontal and cerebellar brain regions that typically mediate temporal discounting is associated with, and may be caused by, abnormal functional brain development in these regions between childhood and adulthood. Furthermore, both abnormal activation and functional maturation appear to be related to poor task performance and clinical severity of ASD.

4 **160.004** Abnormal Functional Connectivity Underling Social-Communicative Impairments in Autism Spectrum Disorder

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Background: Researchers have gained interest on aberrant functional connectivity (FC) in Autism Spectrum Disorder (ASD) over the past decade. However, it is still unclear whether and how abnormal FC between different brain networks is associated with their behavioral impairments. Two key brain networks, default mode network (DMN) and fronto-parietal control network (FPC), are proposed to be associated with social-communicative functions in typical populations. Abnormal FC within these two networks was found recently.
Objectives: Here, we investigated whether the FC between these two networks relates to the social-communicative impairments in ASD by using both group comparison and correlation of individual differences.
Methods: We selected 112 subjects (56 with ASD and 56 typically developing (TD), mean age 19.16 years) from The Autism Brain Imaging Data Exchange (ABIDE) with strict criteria (e.g., matched age, gender and IQ) . We analyzed the resting-fMRI dataset and calculated three brain measures, including a) the amplitude of low frequency fluctuation (ALFF), which reflected the local neuronal activity; b) regional homogeneity (ReHo), which reflected the local FC, c) and FC, which reflect interregional FC strength, in both groups. We compared both groups on these brain measures, and estimated to what extent the degree of FC correlates with the individual differences of social-communicative scores, assessed by ADOS.
Results: The main findings are as follows: (1) we observed increased ReHo in the right middle frontal gyrus (RMFG) in the ASD group. Within the ASD group, individual differences of ReHo in the RMFG ($r = 0.43$, $p < .005$), right superior frontal gyrus (RSFG) ($r = 0.38$, $p < .005$) and right middle temporal gyrus (RMTG) ($r = 0.36$, $p < .005$) were positively correlated with the individual differences of social-communicative deficit. In contrast, the ReHo in the PC ($r = -.45$, $p < 0.001$) showed a negative correlation with the social deficit in the ASD group. (2) We further found that the FC between PC, RSFG (two key regions in the DMN) and the lateral RMFG (a key brain region in the control network) were associated with social impairment. Specifically, the FC between the RMFG and the PC was negatively related to the social symptoms in ASD ($r = -.35$, $p < .01$). (3) We did not find any ALFF group differences. However, individual differences of ALFF in the RMFG ($r = 0.44$, $p < 0.001$), RSFG ($r = 0.39$, $p < .005$), RMTG ($r = 0.4$, $p < 0.001$), and posterior cingulate (PC) ($r = -.42$, $p = .001$) showed significant correlations with the individual differences of social deficit for the ASD group.
Conclusions: Our findings support our hypothesis that abnormal inter-network FC was showed in the ASD group as compared to the TD group. Specifically, the abnormal social-communication functions in autism were highly related to the functional connectivity between the DMN and CN, two key brain networks supporting social and communicative behaviors in typical populations. In summary, our study provided further evidence for the neurophysiological basis of the social barriers in ASD.

5 **160.005** Alterations in Brain Entropy in Autism Spectrum Disorders

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Background: Biological systems typically exhibit complex behavior with nonlinear dynamic properties. Nonlinear signal processing techniques such as sample entropy is a novel approach to characterize the temporal dynamics of the brain. Estimating entropy, the state of uncertainty of a system, is especially important in clinical populations such as autism spectrum disorders (ASD) as higher entropy would entail brain disease. Considering the models of atypical brain network connectivity in ASD, sample entropy would provide a novel dimension to understand brain organization.
Objectives: The main objective of this study is to examine the alterations in brain entropy in resting state functional MRI data in children with ASD. We hypothesize increased brain entropy in children with ASD compared to typically developing (TD) children.
Methods: Resting state fMRI data collected from 22 high-functioning children with ASD and 18 age-and-IQ-matched TD children were preprocessed using the CONN toolbox. This consisted of motion correction, normalization to MNI template (3mm isotropic voxels), spatial blurring (6mm), low-pass filtering ($.008 < f < .08$ Hz), CompCor (a method for identifying principal components associated with white matter and cerebrospinal fluid, CSF), and scrubbing using the ART toolbox. White matter and CSF were entered as nuisance variables along with motion parameters and outliers of head motion detected by ART. Sample entropy was then calculated in a whole-brain voxelwise manner for all subjects with the following parameters based on a previous study (Sokunbi et al., 2013; $r = 0.46$ and $m = 2$). Group differences were assessed using a two-sample *t*-test, and brain-behavior correlations were calculated using sample entropy, Social Communication Questionnaire (SCQ), and Social Responsiveness Scale (SRS) scores from all subjects.
Results: The main results are: I) significantly increased sample entropy in ASD, relative to TD in bilateral insula and right calcarine sulcus; II) significantly reduced sample entropy in ASD, relative to TD in left middle temporal gyrus; and III) positive correlations of average sample entropy in clusters of significant group differences (insula, calcarine sulcus) with SCQ ($r = 0.71$, $p < 0.001$) and SRS ($r = 0.63$, $p < 0.001$) scores across all subjects respectively were found.
Conclusions: Higher sample entropy found in insula and calcarine sulcus in ASD children indicate increased randomness of a system, meaning the dynamic system activity is less predictable and less organized. This might also reflect abnormal brain response in ASD, particularly in visual and salience networks (Samson et al., 2012; Uddin et al., 2013). These findings are consistent with altered sample entropy previously reported in clinical populations such as schizophrenia (Sokunbi et al., 2014), and ADHD (Sokunbi et al., 2014). The correlation of increased sample entropy with ASD symptoms in our study underscores the clinical implications of this neurobiological index.

6 **160.006** Autistic Traits Modulate Gaze and Neural Activity in Constrained Versus Unconstrained Conditions

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Background: Individuals affected by autism spectrum disorder (ASD) often display differences in cognitive control and flexibility which are measured reliably via electroencephalography (EEG) from frontal brain areas. Despite the ostensible ease of resting EEG paradigms, the cognitive demand to maintain fixation on a computer screen elicits differential brain activity in individuals with varying levels of cognitive control and behavioral rigidity. Brain activity via EEG, and gaze patterns, acquired via eye-tracking (ET), can provide information about relationships between behavioral measures, cognitive rigidity and biological states of visual hyposensitivity.
Objectives: Using concurrent ET and EEG recordings, we compared gaze behavior and spectral power between resting experiments where participants were free to look anywhere on a screen (unconstrained) and were required to maintain gaze on a fixation point (constrained). We explored the differential impact of how maintaining fixation affects its relationship with gaze, neural response and autistic traits.
Methods: Resting EEG data was recorded from 10 TD adults (data collection is ongoing) using a 128-channel sensor net. ET was acquired with an EyeLink-1000 camera system. Participants completed: (1) a 2-minute non-constrained viewing task in which they viewed a blank, gray colored screen; (2) a 2-minute constrained viewing task in which they were prompted to maintain gaze for 2 minutes within a dark square in the center of a light background. Self-report measures of behavioral rigidity and other autistic traits included (Broad Autism Phenotype Questionnaire; BAPQ) and sensory behavior (Glasgow Sensory Questionnaire; GSQ).
Results: Constrained vs. unconstrained viewing conditions demonstrated an overall reduction of delta power by 20%. Lateralized posterior beta power positively correlated with rigidity as measured by the BAPQ (left: r=.658, p=.039; right: r=.642, p=.045). Fixation duration in unconstrained contexts correlated negatively with visual hyposensitivity (r=-.646, p<0.05). Central and midline gamma during unconstrained viewing correlated with elevated levels of visual hyposensitivity (central: r=.723, p=.018; midline: r=.719, p=.019). Pupil diameter in unconstrained viewing correlated positively with visual hyposensitivity (r=.655, p<0.05).
Conclusions: Our data shows that differing relationships between brain activity, attention and autistic traits are revealed and dependent upon task demands in a resting context. Additionally, observations of pupil diameter during constrained conditions suggested that increased arousal is reflective of higher behavioral rigidity when instructed to maintain gaze. Increased fixation duration in unconstrained contexts indicates higher levels of attention amongst individuals with self-reports of high behavioral rigidity. This study highlights the importance in understanding the relationship of some observable behaviors and brain activity. By exploring the connections between gaze behaviors, brain activity and the clinical phenotype of ASD under differing task demands, we elucidate the extent to which brain and behavior differences reflect stable individual differences (trait) versus task dependent effect (state). These findings will guide the development of novel and appropriate methods for measuring brain activity in individuals with ASD.

7 **160.007** Behavioral Response Error Monitoring and Correction Function Deficits in Autism

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Background: Error monitoring and correction is one of the executive functions and is important for effective goal directed behavior. Deficient executive functioning, including reduced error monitoring ability, is one of the typical features of such neurodevelopmental disorders as autism resulting in perseverative responding, stereotyped repetitive behaviors, and an inability to accurately monitor ongoing behavior. Our prior studies of behavioral and event-related potential (ERP) measures during performance on three-stimuli visual oddball tasks in high-functioning autistic (HFA) children showed that despite only minor differences in reaction times HFA children committed significantly more errors.
Objectives: The main goal of the study was to compare behavioral responses and error-monitoring correcting functions in children with ASD and typically developing children.
Methods: This study investigated error monitoring in children with autism spectrum disorder (ASD) with response-locked event-related potentials - the error-related negativity (ERN) and error-related positivity (Pe) recorded at fronto-central sites using dense-array Electrical Geodesics EEG Net Sensor system . The ERN reflects early error detection processes, while Pe has been associated with more late conscious error evaluation and attention re-allocation. Reaction times (RT) in correct trials and post-error slowing in reaction times was measured. Fourteen subjects with ASD and 14 age- and IQ- matched controls were administered a three-category visual oddball task with novel distracters.
Results: The analysis of data showed that the ERN and the Pe component of the response-locked ERP were substantially decreased in children with autism as compared to typical controls. The ERN had lower amplitude and longer latency in ASD group but localized in the caudal part of anterior cingulate cortex (ACC) in both groups. The Pe component was significantly prolonged but did not reach significant amplitude differences in ASD group compared to controls. We found significant post-error slowing in RTs in controls, and post-error acceleration in RTs in ASD group.
Conclusions: The reduced ERN and altered Pe along with a lack of post-error RT slowing in autism might be interpreted as an insensitivity to detect and monitor response errors and reduced ability of execute corrective actions. This might result in reduced error awareness and a failure in adjustment when dealing with situations where erroneous responses may occur. This deficit might be manifested in the perseverative behaviors often seen in individuals with ASD. The results are discussed in terms of a general impairment in self-monitoring and other executive functions underlying behavioral and social disturbances in ASD.

8 **160.008** Bias Towards within-Network Functional Connectivity Among Toddlers with ASD during Resting State

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Background: While a small number of studies in younger participants suggest that atypical network connectivity patterns observed in adults with ASD begin much earlier in development (Dinstein et al., 2011; Lombardo et al., 2015; Shen et al., 2016), no studies have specifically investigated how the complex changes in within- and between-network connectivity dynamics previously observed in typically developing (TD) infants and toddlers (Gao et al., 2016) may differ in ASD. Of particular importance are examinations of resting state networks that develop in early life, such as primary sensory networks, as well as the default mode network (DMN), which is thought to be the cornerstone of self-referential processing and has previously been shown to have atypical connectivity in adults with ASD.
Objectives: Using resting state fMRI, we compared brain network connectivity between a group of ASD toddlers (N=47, mean age=26.5, range=14.2-44.1) and matched group of TD toddlers (N=47, mean age=26.5, range=13.2-44.5). We first compared connectivity between nodes across several networks on a node-to-node basis. We then compared the balance of within-network to between-network connectivity. Finally, we tested whether the developmental trajectories of brain connectivity differ between ASD and TD groups over the age range of our participants.
Methods: With resting state fMRI time series extracted from the set of 264 spherical ROIs (Power et al., 2011), we conducted mass univariate testing using the Network Based Statistic method (Zalesky et al., 2010). Next, using resting state fMRI time series extracted from a set of 333 ROIs based on a functional cortical parcellation map (Gordon et al. 2014), we defined within-network connectivity (WNC) for each network as the average of correlations between each pair of seeds belonging to a network. We defined between-network connectivity (BNC) for each network as the average correlation between each seed of that network and each other seed in all other networks. The Within-Network Bias (WNB) for each network was then calculated as the percentage of the total strength of all of its connections (WNC+BNC) attributed to the strength of its WNC. Finally, we tested for interactions between age and WNB across networks and groups, using a GLM approach.
Results: Using NBS, we found a graph component consisting of 25 connections between 24 seed ROIs in which ASD showed significantly lower connectivity compared to TD (FWER-corrected p=0.0368). The 24 ROIs belonged to the following networks: 8 in DMN, 7 in salience, 4 in visual, 2 in cingulate-operculum, 2 in auditory, and 1 in subcortical (Figure 1). ASD showed significantly higher WNB across all networks compared to TD (p=0.006, Figure 2). In a series of follow-up GLMs examining the interaction of participant age and WNB for each individual network, there was a significant interaction between group and age for the auditory network (p=0.0428).
Conclusions: We found evidence for hypoconnectivity between DMN, visual, and salience networks, and a global bias towards within-network connectivity in ASD toddlers. Our results demonstrate developmental differences of large-scale brain network connectivity between typically developing toddlers and those in the pre- or early clinical stages of ASD.

9 **160.009** Characterizing the Heterogeneity in Autism Spectrum Disorder Using Brain Connectivity Underlying Social Cognition

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Background: Autism Spectrum Disorder (ASD) is characterized by deficits in theory-of-mind (ToM) which negatively impact social interaction. Previous neuroimaging studies have found alterations in ToM brain network in individuals with ASD. However, most of these studies rely on standard fMRI analyses which concatenate results to arrive at a group-level model that may not be reflective of many or most of the participants within a heterogeneous group. A novel approach to studying functional connectivity that accounts for the heterogeneity of ToM regions in an ASD population is the *Group Iterative Multiple Model Estimation* (GIMME) algorithm which reveals divergent subgroups based on patterns of functional connectivity among a priori regions of interest (ROI) using a structural equation modeling framework.
Objectives: To examine the nature and extent of neural heterogeneity across ASD and typically developing (TD) participants in an fMRI study of ToM processing.
Methods: A total of 63 participants (32 ASD and 31 age-and-IQ-matched TD) between the ages of 10 and 36 years took part in this fMRI study. In the scanner, participants watched animations of geometrical shapes depicting ToM. ROIs were derived from a *Neurosynth* mask based on previous studies of ToM and included: left and right inferior frontal gyrus (LIFG; RIFG), left precuneus (LPCUN), left and right posterior superior temporal sulcus (LpSTS; RpSTS), and medial prefrontal cortex (MPFC). Based on the fMRI time-series information extracted from each ROI during the ToM condition, GIMME identifies the presence and direction of connections among the ROIs to arrive at a group level model that is then tested at the individual level to determine if subgroups exist within the data that differ from the group model.
Results: A group connectivity map was found with connections from MPFC to LIFG, LpSTS to MPFC and to LPCUN, and RpSTS to LpSTS. Within the ToM condition, two functional connectivity-based subgroups were identified: Subgroup A comprising 28% of the ASD and 39% of the TD participants was characterized by increased connectivity from LPCUN to RpSTS as well as increased connectivity from MPFC to RIFG. Conversely, Subgroup B which contained 72% of the ASD and 61% of the TD participants showed comparatively weaker connectivity with no additional pathways emerging above the group level model. Statistical comparisons of the individuals comprising the two subgroups revealed stronger connectivity of the group level connection from LpSTS to MPFC in Subgroup A compared to Subgroup B (t_{61} = -3.118, p< .05). No group level paths were stronger for Subgroup B.
Conclusions: The pattern of results within the ToM condition suggests possible underconnectivity in the group containing the largest percentage of ASD participants. The GIMME algorithm, which is blind to diagnostic classification, was able to detect the presence and direction of connections within a heterogeneous sample during a task-based fMRI study of ToM. The findings of this study are preliminary, and there are several follow-up analyses planned. These results should be examined further in the context of the diagnostic and demographic makeup of the subgroups.

10 **160.010** Comparison of Functional Connectivity Abnormalities in Autism and Williams Syndrome

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Background: Williams Syndrome and autism both exhibit characteristic social impairments, but differ in the specific social phenotype, with autism exhibiting social avoidance and Williams Syndrome exhibiting enthusiasm for social engagement but impaired skills in social interaction and also associated cognitive impairment. Differences in relationships between social brain regions in each condition may offer clues to how these divergent social impairment phenotypes may arise.
Objectives: We compared brain functional connectivity within the social brain for a large subset of autism patients from the ABIDE dataset and a smaller group of individuals with Williams Syndrome as well as individuals with typical development obtained locally.
Methods: Functional connectivity MRI measurements were performed during viewing of Looney Tunes cartoon videos in 13 subjects with Williams Syndrome and 10 typically developing subjects, grouop matched for age and sex (age range 14-35). Each subject viewed up to 7 cartoons of 7 minutes each, for a total of 67 7-minute scans in controls and 71 7-minute scans in Williams Syndrome participants. Imaging was acquired using multiband BOLD protocol on a Siemens Trio 3T scanner (TR = 730 ms, 2 x 2 x 2 mm resolution, 32 channel head coil). Postprocessing included motion correction, coregistration to MP2RAGE anatomic image, normalization to MNI space, and voxelwise regression of degraded ROIs within white matter, CSF, facial soft tissues, and time series from heart rate and respiratory waveforms obtained during scanning. Time series were extracted for 333 cortical regions parcellating cortical gray matter, 14 subcortical regions obtained from FreeSurfer-derived subject-specific segmentation of deep gray nuceli, and 14 cerebellar ROIs. Functional connectivity was measured in each pair of ROIs. Independently, functional connectivity was measured from the ABIDE dataset consisting of 972 autism and control subjects acquired from multiple sites with conventional resting state acquisition. Postprocessing was analagous with exception of heart rate and respiratory waveform regression. Regions showing connectivity abnormalities in each dataset were compared to a map of the social brain obtained from a reverse inference from the NeuroSynth.org website for the term "social," identifying regions significantly associated with the term social in the functional neuroimaging literature. Significant differences in connectivity were established using false discovery rate correction for multiple comparisons across all region pairs.
Results: Individuals with Williams Syndrome, compared to typically developing controls, exhibited widespread, significant decreases in cortico-cortical and cortico-subcortical connectivity. Regions most frequently involved in atypically decreased connectivity in Williams Syndrome included hubs of the social brain: medial prefrontal, inferior parietal, superior temporal sulcus, and amygdalar regions. Individuals with autism showed similar regions of greatest cortical underconnectivity, but also exhibited additional atypical connections not seen in Williams Syndrome, including decreased left-right homotopic connectivity and increased connectivity between default mode and salience networks.
Conclusions: We observe similar underconnectivity of social brain regions in Williams Syndrome and autism, but with differences in the functional connectivity pattern: homotopic underconnectivity, corticostriatal overconnectivity, and increased connectivity between default mode and attentional networks in autism, but more widespread corticocortical underconnectivity in Williams Syndrome. Such differences may contribute to differences in social impairment phenotype between the two conditions.

11 **160.011** Comparison of Neural Response to Language in Infants at Elevated Risk for ASD and in Infants with Nonsyndromic Craniosynostosis

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Background: Autism spectrum disorder (ASD) is characterized by impaired social interaction and communication. While language skills vary widely among individuals with ASD, language delay in infants is an important prognostic feature of ASD severity. The study of auditory event-related potentials (ERPs) in infants at high-risk for ASD (HR-ASD) has demonstrated atypical responses in several ERP components compared to typically-developing (TD) controls. To better understand the specificity of atypical neural response to language in ASD, clinical comparisons are needed. Nonsyndromic craniosynostosis (NSC), a congenital disorder characterized by the premature fusion of cranial vault sutures, is associated with impairments in learning and language that may resemble the deficits found in ASD. Mismatch negativity (MMN), an ERP component found between 80-300ms, has been used to index language acquisition via the phenomenon of perceptual narrowing.
Objectives: To compare neural response to auditory stimuli in HR-ASD and NSC in order to characterize specificity of language acquisition deficits in ASD.
Methods: 12 HR-ASD infants were recruited from the Yale Autism Program. 15 infants with NSC were enrolled from the Yale Craniofacial Clinic. 35 TD infants were used as age-matched controls. Participants were presented with a non-native phoneme discrimination task involving five blocks of ten repetitions each of the Hindi retroflex phoneme /da/ and the dental phoneme /da/ in random order. Auditory stimuli were presented at 80 dB, and EEG was recorded at 250 Hz using a 128-channel HydroCel Geodesic Sensor Net. Analysis focused on selected electrode clusters from four regions of interest: the left frontal, right frontal, left central, and right central clusters. The MMN component was calculated as the largest negative amplitude in the difference wave between 80-300ms after the stimulus.
Results: In the left frontal region, HR-ASD demonstrated marginally attenuated MMN compared to TDs (p=.092), while NSC demonstrated significantly attenuated MMN compared to TDs (p=.011). There were no significant differences in any electrode cluster between HR-ASD and NSC (ps>.05). All other pairwise comparisons did not show significant differences in MMN amplitude between different groups or within groups in different brain regions.
Conclusions: Previous work has shown that while TD infants demonstrate lateralized response to language, neither HR-ASD nor NSC infants display significant hemispheric lateralization. This atypical lateralization has previously been suggested to be an endophenotype of ASD that can be detected early in life. Our current study revealed significantly decreased MMN amplitude in NSC but not HR-ASD infants. Thus, while HR-ASD and craniosynostosis may share certain similarities in auditory response, such as atypical lateralization, there may also be differing neural processes that distinguish these two. Results suggest that additional research is required to understand variably impacted MMN in HR-ASD populations.

12 **160.012** Decreased Slow-Wave Activity in Sleeping Children with Autism

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Background:
Sleep abnormalities are prominent in children with autism as demonstrated by studies using parent questionnaires and/or assessments of sleep architecture (e.g., reports of reduced REM sleep durations in autism). Very few studies, however, have examined EEG spectral properties in overnight recordings from young children with autism. Slow-wave sleep refers to the deep sleep stages (S3 and S4 of non-REM sleep), which can be quantified using EEG by examining slow-wave activity (SWA, in the 0.75- to 4.5-Hz range). The amplitude of SWA is a marker of the pressure to sleep: it is large during sleep onset and decreases in magnitude throughout the night. Previous studies have reported that reduced SWA power is associated with diverse cognitive impairments. Here, we compared SWA in retrospective polysomnography (PSG) exams of children with and without autism.
Objectives: N/A
Methods:
We identified PSG recordings of 11 children with autism (5.1 ±2 years old), 11 control children with no sleep apnea (5.5 ±1.9), and 10 children with mild obstructive sleep apnea (5.5 ±2). All PSGs were performed at the Soroka Sleep-Wake Disorders Unit between 2008 and 2012. PSG's were re-scored blindly by one of the investigators (A.T). We then computed the relative and absolute SWA in addition to EEG power in the Delta (1-4Hz), Theta (4-8Hz), Alpha (8-13Hz) and Beta (13-20Hz) frequency bands for each sleep stage.
Results:
Children with autism had significantly lower Delta power and larger Beta power during N2, N3, and REM sleep compared to both control groups. SWA was significantly reduced in the autism group throughout the night. In addition, we found that children with autism spent relatively less time in REM sleep than the two control groups.
Conclusions:
Children with autism exhibit significantly smaller magnitudes of SWA, which have previously been associated with cognitive problems in, for example, children with apnea. Additional research is necessary for determining whether cognitive and social impairments in children with autism are associated with these sleep abnormalities.

13 **160.013** Delayed but Not Deviant Developmental Trajectories Related to Language Impairment in Children with Autism Spectrum Disorder: Neural and Behavioral Evidence

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Background: It has been estimated that half of all children with ASD have co-occurring *language impairment* (ASD+LI, Blumberg, Bramlett, Kogan, Schieve & Jones, 2007). Eigsti and Bennetto (2009) found that the language abilities of these children lag behind the typical developmental trajectory (i.e., showing delay in development rather than deviance). Neural studies have proposed that atypical brain responses to sound underlie the language impairments in children with ASD (e.g., Oram Cardy, Flagg, Roberts & Roberts, 2008). However, brain function studies to date have not determined whether atypical neural response patterns are reflective of a developmental delay or deviance trajectory.
Objectives: To explore whether patterns of developmental delay or deviance in brain responses to sounds are related to language delays in children with ASD+LI.
Methods: Twenty-two children with ASD (*N*=13 without LI: ASD-LI; *N*=9 with LI: ASD+LI) participated. To explore the neural responses to sound, a 128-channel EGI system recorded *auditory evoked potentials (AEPs)* elicited by 225 trials of a 50ms, 490Hz tone. The *Clinical Evaluation of Language Fundamentals – 4 (CELF-4)*was administered to measure language ability. The following statistical analyses were performed to identify patterns of delay or deviance:

- **For language abilities:** Scatter-value (*S-value,* VanMeter, Fein, Morris, Waterhouse & Allen, 1997) was calculated based on the individual test items that each participant answered incorrectly using the equation S = sqrt(P xÂ ∑W), where peak (P) = the last correctly answered item and weight (W) = percentage of children with *typical development (TD)* who answered correctly (calculated from our previously established normative database). Children with a developmentally deviant language ability will show more intra-test scatter than their peers and earn higher S-values.
- **For neural responses:** For each participant, an AEP segment from 0-500ms post-stimulus presentation was compared to normative AEPs we previously established from 74 children with TD. Using intraclass correlation coefficient (ICC) as an indicator of resemblance, the AEPs of children with ASD were assigned an age-equivalent based on the comparison that yielded the highest resemblance score. Low resemblance of a participant's waveform compared to all normative waveforms result in a low ICC value, indicating a pattern of deviance in neural responses.

Results: Â As expected, children with ASD+LI scored lower on the CELF-4 compared to children with ASD-LI. However, the ASD+LI group did not have higher S-values on the CELF-4 than the ASD-LI or language-matched TD groups (see Table).In other words, there was no evidence to suggest a pattern of developmental deviance in the language performance of children with ASD+LI. Despite being equivalent in chronological age, children with ASD+LI had significantly younger AEPs than children with ASD-LI. The ASD+LI group did not have lower ICC-values when compared to ASD+LI or language-matched TD groups. This finding suggests that brain responses to sounds in the ASD+LI group are delayed relative to, rather than deviant from, a typical developmental trajectory.
Conclusions: Our data suggest that developmental delay in the neural responses to sound underlies the language delay in children with ASD+LI. Both the neural and behavioral data point to trajectories characteristic of younger children with typical development.

14 **160.014** Developmental Differences in the N170 in Individuals with Autism Spectrum Disorder

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Background:
Individuals with autism spectrum disorder (ASD) demonstrate deficits in processing both high and low intensity emotions in faces (Garman et al., 2016). However, changes in efficiency of processing across development remain unclear. The N170 event-related potential (ERP) component, recorded via electroencephalogram (EEG), is an early neural index of face processing (Bentin et al., 1996; Eimer, 2000; Nelson & McCleery, 2008). Previous research has shown that as children increase in age (regardless of ASD status), their N170 latencies decrease until age ~11 (Batty & Taylor, 2006 Hileman et al., 2011; Batty et al., 2011). However, in typically developing (TD) children, this process seems to plateau around age 14 (Batty & Taylor, 2006). No known studies have examined the relationship between N170 latencies and facial processing from childhood into adulthood. Additionally, previous research using the Diagnostic Analysis for Nonverbal Accuracy-2 (DANVA-2; Nowicki, 2004), a standardized paradigm assessing facial emotion recognition, has demonstrated that N170 latencies to high and low intensity emotional face stimuli are slower in ASD compared to TD individuals (McPartland et al., 2011). Studies have not examined how deficits in facial emotion processing or symptom severity in individuals with ASD may affect the relationship between age and N170.
Objectives:
The current study 1) examined if age correlated with N170 latencies in response to high and low intensity emotional facial stimuli in a sample of individuals with ASD spanning childhood and adulthood. Additionally, 2) we examine whether ASD severity and performance on the emotion recognition task, moderated the relationship between age and N170.
Methods:
Thirty-seven individuals (29 male; M_{age} = 17.62 SD_{age} = 8.55) with ADOS-2-confirmed ASD, completed the DANVA-2 emotion recognition task while concurrent EEG was recorded. N170 latency to high and low intensity faces were extracted. Additionally, the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005) was administered to adult participants as well as parents of youth participants to measure ASD symptom severity.
Results:
Age correlated negatively with N170 latency to overall faces (-0.415 p = 0.011) as well as to high intensity faces (r = -0.332 p = 0.045) and low intensity faces (r = -0.375 p = 0.022). Neither SRS-2 scores nor errors made on the DANVA-2 moderated the relationship between age and N170 latency to overall, high intensity, or low intensity faces.
Conclusions:
N170 latencies to overall emotional faces were negatively correlated with age from childhood into adulthood. Additionally, the relationship between age and N170 was not moderated by ASD severity nor DANVA-2 performance. These results suggest that individuals with ASD evince increased processing efficiency (shorter N170 latency) with age regardless of level of ASD symptomatology or performance on the emotion recognition task. These findings also indicate that neurodevelopment of basic face processing (across levels of emotional intensity) may continue in individuals with ASD beyond the period in which this is evident in TD individuals. As such, this intimates the possibility of either delayed development of social-emotional neural systems, opportunities for enduring neuroplasticity (and therefore intervention) into young adulthood in this population, or both.

15 **160.015** Differences in the Late Positive Potential ERP As a Function of Valence Versus Intensity in Adults with and without ASD

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Background: Research suggests that individuals with Autism Spectrum Disorder (ASD) demonstrate aberrant neural processing of emotionally salient social stimuli (Lerner et al., 2013). Research has focused on *early stage* face processing as indexed by the N170 and VPP event-related potentials (ERP) recorded via electroencephalogram (EEG; Bentin et al. , 1996; Faja, et al. 2016) showing blunted processing of emotional faces in individuals with ASD (McPartland et al., 2011). While these findings have been well-replicated, ERP research focusing on the *later stages* of emotional face processing in ASD has been largely neglected. The late positive potential (LPP), a slow wave ERP beginning 300ms after stimulus onset, is associated with sustained attention and motivation and larger amplitudes are found in response to salient emotional stimuli in typically developing (TD) individuals (Hajcak et al., 2009). One study has examined the LPP in individuals with ASD, finding an enhanced LPP to nonsocial vs. positive social stimuli (Benning et al., 2016). However, this study did not (1) control for differences in amplitude of early facial processing, which may evince differences that prefigure the LPP, and (2) identify whether LPP differences in the ASD group were a function of stimulus valence or intensity. It is essential to parse apart the stimulus qualities that contribute to LPP differences to better understand social emotional processing deficits.
Objectives: This study examined differential LPP response to high vs. low intensity and positively vs. negatively valenced emotional in individuals with and without ASD while controlling for differences in amplitude of early stage processing.
Methods: Thirty-two TD adults (10 male; M_{age}=22, SD_{age}=6.0), and 13 IQ-matched adults with ADOS-2 confirmed ASD diagnosis (11 male; M_{age}=27, SD_{age}=6.8) completed an ERP measure of facial emotion recognition (DANVA-2; Nowicki, 2004). VPP and LPP to high and low intensity, and positively and negatively valenced, emotional faces were extracted from ERP data. We examined the interaction between stimulus type (high vs. low or positive vs. negative) and diagnosis for LPP via repeated measures ANOVAs while covarying VPP amplitude.
Results: There was a significant interaction between intensity level and diagnosis (F=5.35, p<.05) such that individuals with ASD had a smaller LPP amplitude to high intensity faces (B = .28, p<.05; Figure 1). This interaction was robust to controlling for VPP amplitude to high intensity faces (F=5.62, p<.05). There was no effect for LPP for valence by condition.
Conclusions: While their slow wave neural responses to emotional valence appear to be intact, individuals with ASD demonstrate attenuated motivated attention to high intensity social emotional stimuli compared to their TD peers even when controlling for amplitude differences in early processing (i.e. VPP). Although previous research has focused on *early* ERP differences in processing low intensity emotions which may reflect blunted initial sensory processing, the current findings highlight attenuated *later stage* processing of high intensity faces, suggesting diminished motivational response to highly salient social information in the ASD group relative to TD controls. This study suggests that deficits in processing social emotional information vary across stages of processing in individuals with ASD.

16 **160.016** Distinct Brain Regions Associated with Item and Relational Encoding Impairments in ASD

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Background: The human brain is adept at storing and retrieving information from experienced events, and this 'episodic memory' system is critical to adaptive functioning in everyday life. Individuals with autism spectrum disorders (ASD) demonstrate a marked impairment in episodic memory, but the neurocognitive bases of this impairment remain unclear. The Relational and Item-Specific Encoding (RiSE) task was developed to differentiate the abilities to remember specific stimuli (item-specific encoding) and associative memory for relationships between stimuli (relational encoding). In a recent study, individuals with ASD showed impaired performance on the RiSE, particularly in the item-specific encoding condition (Solomon, McCauley, Iosif, Carter, & Ragland, 2016).
Objectives: The present study was designed to further investigate item-specific and relational encoding in ASD, and to use functional magnetic resonance imaging (fMRI) to elucidate the neural bases of episodic memory impairments in this population.Â
Methods: Data collection is ongoing, but currently 17 young adults and adolescents with ASD and 19 typically-developing participants (TYP) have completed the RiSE in an fMRI environment. The RiSE consists of two phases: i) an encoding phase where items are presented in pairs while participants are instructed to attend to the items themselves ("is one of the items living?") or to the relationship between items ("can one item fit inside the other?"), and ii) an item recognition (IR) phase where studied items are intermixed with unstudied foils and participants judge whether each item is "old" or "new". IR accuracy was analyzed using a 2 (encoding condition) x 2 (diagnosis) ANOVA, and preliminary fMRI data were analyzed using a mixed-effects model (FSL's FLAME1, uncorrected p<.01) and a region-of-interest mask derived from 270 'episodic memory' studies in the *Neurosynth* data archive.
Results: Behaviorally, we observed significant improvements in accuracy following relational encoding relative to item encoding (p<.001, h^2=0.61), and a generalized impairment across encoding conditions in the ASD group (Item: p=.03, d=0.76; Relational: p=.04, d=0.72), with no evidence of an interaction (p=.67). Preliminary fMRI analyses revealed that item and relational encoding impairments were associated with distinct patterns of brain activity. In both the ASD and TYP groups, encoding recruited medial temporal lobe (MTL) and dorsolateral prefrontal cortex (dlPFC), with dlPFC demonstrating greater recruitment during relational vs. item encoding. Between groups, relational encoding was associated with greater recruitment of dlPFC in TYP relative to ASD, but similar levels of MTL recruitment. In contrast, the TYP group demonstrated greater MTL recruitment in the item-specific encoding condition than the ASD group.
Conclusions: The present study provides further evidence for an episodic memory impairment in ASD, which was observed regardless of whether information was encoded in an item-specific or relational fashion. Furthermore, the study provides novel fMRI evidence that distinct MTL and PFC subregions may be associated with item and relational encoding impairments in ASD, respectively, which could lead to a better understanding of the neural mechanisms underlying different types of memory failures in ASD. As data collection is ongoing, rigorous methodological standards for statistical power and multiple comparisons correction will be implemented prior to IMFAR 2017.

17 **160.017** ERN As a Predictor of Treatment Response to Social Skills Interventions in ASD

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Background: Larger neural responses to error commission are a biomarker for increased anxiety symptoms (Meyer et al., 2015) and are measured by error-related negativity (ERN) amplitudes, an event-related potential (ERP) component measured via electroencephalogram (EEG). However, the extent to which this is true in youth with ASD is still unclear (Boulter et al., 2014; vs. Henderson et al., 2006; 2016). Moreover, while anxiety, when measured by informant-report, has been shown to moderate treatment outcomes in ASD (e.g., Pellecchia et al., 2015), physiological indices of anxiety, such as the ERN, have not been examined in this manner. Therefore, we aimed to examine the relation of the ERN to 1) anxiety symptoms in youth with ASD, and 2) anxiety and ASD-related treatment outcomes in youth with ASD following Social Skills Intervention (SSI).
Objectives: This study examined whether differences in neural responses of ERN amplitudes at baseline index anxiety in ASD and predict treatment response to SSI.
Methods: Thirty-seven youth (M_{age}=12.11, SD_{age}=2.91; 29 male) with IQ≥70 (M_{IQ}=104.68, SD_{IQ}=15.84) and ADOS-2-confirmed ASD diagnosis participated in a 10-week SSI. At pre- and post-treatment, parents completed ratings of psychopathology, anxiety and ASD symptomatology, respectively (CASI-5, Gadow & Sprafkin, 2016; SRS-2, Constantino & Gruber, 2005), and participants' rated general and social anxiety symptoms (MASC-2; March et al., 1997; SAS, La Greca & Lopez, 1998). At baseline, unstandardized residual scores of the mean ERN amplitudes were computed by saving the variance leftover in a regression equation wherein the Correct Response Negativity (CRN) was regressed on the ERN (Meyer et al., 2016).
Results: Residualized ERN amplitudes correlated with parent reported symptoms of general anxiety disorder at baseline on the CASI-5 (r= -0.322, p= 0.052). Residualized ERN amplitudes predicted change (via ANCOVA-of-change models) in self-reported treatment outcomes of total social anxiety symptoms, as measured by the SAS (B=0.400, p=0.001) and anxiety symptoms, as measured by the MASC-self (B= .887, p=0.008), wherein smaller ERN amplitudes predicted *greater* treatment-related improvements, but *larger* ERN predicted *attenuated* improvements. MASC-self effects were driven by general anxiety disorder, humiliation and rejection, performance fear, social anxiety, obsession and compulsions, panic, and physical symptoms (all B > .608, p < .041), but not separation anxiety, tension or restlessness, or harm avoidance (all p>.241). No effects of ERN on treatment outcomes of ASD related symptoms on the SRS were found.
Conclusions: Results suggest that the ERN relates to concurrent parent-reported anxiety symptoms in youth with ASD, replicating previous work in children with anxiety disorders (Meyer et al., 2015) and ASD (Boulter et al., 2013, but see Henderson et al., 2006, 2016). We found that the *direction of change* on multiple self-report anxiety measures was dependent on baseline ERNs, such that smaller ERNs predicted augmented – but larger ERN predicted attenuated – treatment effects.Â This pattern of results suggests that the ERN may be a marker for subjective anxiety treatment response, but not parent-observable anxiety symptom or ASD symptom treatment response after SSI. Thus, the ERN may be a useful predictor of individual differences regarding self-reported anxiety symptom reduction following an SSI.

18 **160.018** Early Childhood Longitudinal EEG Analysis to Investigate Neural Correlates of Language in Children at Risk for Autism

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Background: Â The neural mechanisms of autism spectrum disorders (ASD) are still poorly understood. In part, this is due to the complexity and heterogeneity of the disorder and our limited understanding of typical neural processing in early childhood. Longitudinal studies of infants at increased familial risk for autism are needed to uncover early differences in neural circuitry in ASD and identify which abnormalities impact language and cognitive development.
Rhythmic synchronization of brain activity in the gamma frequency range (~30-50Hz) is thought to be crucial for higher order cognitive processing, including sensory integration and binding of information. Differences in gamma have been observed in older children and adults with ASD. In typical infants, recent EEG studies also support gamma's association with language processing, with increased gamma power at 2 years of age correlating with better language ability.
Objectives: Â To characterize spontaneous gamma power and its correlation with language ability in infants and toddlers at risk for ASD compared to low risk children.
Methods: This study analyzed EEG data collected as part of the Infant Sibling Project, a longitudinal study comparing infants at high risk of developing ASD with low risk controls. Infants with a sibling with ASD were designated high risk, while infants with least one typically developing sibling and no known first degree relatives with ASD were designated low risk. Each infant was developmentally evaluated at multiple intervals, including 24 and 36 months by the Mullen Scales of Early Learning. Infants were evaluated for ASD at 24 and 36 months. High-density spontaneous EEG recordings conducted at 12, 18 and 24 months of age were analyzed. Spontaneous frontal gamma power at these ages was correlated with language outcomes at 24 and 36 months.
Results: Spontaneous frontal mean gamma power was not significantly different at 12, 18, or 24 months between low risk (LR) and high risk (HR) groups, including the subgroup of high risk children with ASD (HR/ASD). However, *correlation* of spontaneous gamma power and language skills at 24 months was directionally opposite and significantly different between LR and HR groups (Fisher z-transform; -1.91, $p<0.05$; n=36 LR, 33 HR). At 24 months left frontal gamma power was *positively* correlated with language skills in the LR group (Pearson r = 0.351, $p<0.05$), but *negatively* correlated in the HR group (Pearson r = -0.354, $p<0.05$), and the HR/ASD subgroup (Pearson r = -0.51, $p>0.05$, n=8).
Conclusions: Preliminary EEG analyses support differences in the function of spontaneous frontal gamma power in LR and HR children. While LR and HR groups had similar mean frontal gamma power, the correlation between gamma power and language ability is strikingly different. Future analysis of evoked gamma in auditory language tasks will help to further elucidate these differences.

19 **160.019** Electrophysiological Markers of a Potential Excitatory:Inhibitory Imbalance in Children with Autism Spectrum Disorder

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Background: Â Sensory processing abnormalities are a core feature of Autism Spectrum Disorder (ASD). Emergent evidence suggests that hyper- or hypo-reactivity to sensory input(s) in ASD may be due to a neurochemical imbalance between excitatory glutamate (Glu) and inhibitory γ-aminobutyric acid (GABA) neurotransmission, also known as the excitatory:inhibitory (E:I) theory of ASD.
Objectives: To explore possible consequences of imbalanced GABA:Glu neurotransmission on the visual system, we investigated surround suppression in ASD using a visual motion processing task during electroencephalography (EEG) recording to derive the N1 event related potential (ERP). Behavioral studies have demonstrated that healthy adults have a directional impairment of discrimination in conditions of large/high-contrast visual stimuli, which is thought to reflect surround suppression of motion selective neurons and to be driven by GABA (Tadin et al., 2003; Aaen-Stockdale et al., 2009). Behaviorally, individuals with ASD have demonstrated weakened surround suppression, i.e. a selective enhancement of motion perception in conditions of large, high-contrast stimuli (Foss-Feig et al., 2013; Horder et al., 2014). To our knowledge, there have been no prior studies to investigate an ERP marker of surround suppression. To validate this paradigm, we demonstrated that healthy adults have delayed processing in conditions of large/high-contrast thought to reflect surround suppression as indexed by N1 ERP latency ($p=0.013$).
Methods: Â In the pilot study, five high-functioning medication-free children with ASD based on DSM-5 criteria and four typically developing children from 7 – 12 years of age were recruited. ASD classification was confirmed using the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) (Lord et al., 2012). All participants reported no history of neurological disorder and had normal or corrected-to-normal vision. Participants were screened for a contrast-sensitivity impairment using the Pelli-Robson Contrast Sensitivity Acuity Chart. During EEG recording participants completed a visual processing task. Stimuli were programmed using Psykinematix (Beaudot, 2009) and consisted of 1 cycle/degree drifting vertical sine wave gratings surrounded by two-dimensional Gaussian envelopes drifting either right or left at a consistent speed. Stimulus size (large vs. small) was either 5.0° or 0.7° and stimulus contrast (bright vs. faint) was either 92% or 2.8%. Recruitment is ongoing for the main study.
Results: In the high-contrast experiment, we demonstrated children with ASD have significantly enhanced processing of large stimuli compared to small stimuli thought to reflect weakened surround suppression ($t(4) = 5.023$, $p=0.007$) as indexed by N1 ERP latency. Typically developing children did not demonstrate N1 ERP latency differences in the high-contrast experiment ($t(3) = -2.296$, $p=.105$). Children with ASD had significantly shorter N1 ERP latencies to large/high contrast-stimuli than typically developing children ($t(7) = -3.953$, $p=0.006$). As expected, there were no processing differences between stimuli sizes in conditions of low contrast, since surround suppression is contrast-dependent.
Conclusions: Medication free children with ASD demonstrated weakened surround suppression. Shorter N1 latencies in conditions of large, high-contrast stimuli could lend support to the E:I imbalance theory of ASD. This paradigm may have potential for use as a clinical outcome measure in research trials to evaluate the effectiveness of investigational pharmaceuticals that act on GABAergic neurotransmission.

20 **160.020** Exclusion Bias in ASD fMRI Studies: The Effect of Participant Anxiety on Scan Motion Artifact

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Background: Functional MRI (fMRI) is used to understand the neurobiological basis of neurodevelopmental disorders, such as Autism Spectrum Disorder (ASD). While data from an fMRI scan can be highly informative, it is susceptible to artifacts caused by participant motion. Previous literature suggests that 30% of data is lost from scans conducted with ASD participants due to scan motion artifacts (Yerys et al., 2009). Researchers can effectuate methods to reduce these motion artifacts with use of mock scanner training protocols (de Bie et al., 2010; Raschle et al., 2012; Nordahl et al., 2016). Nevertheless, there are some variables that may increase motion but are difficult to control, such as participant trait anxiety. Given the high co-morbidity of anxiety disorders in individuals with ASD, it is important to consider whether anxiety affects fMRI data quality and leads to exclusion biases. No previous study has examined the relation between anxiety-like symptoms and scan motion in a childhood ASD sample.
Objectives: We investigated the relation between child-reported and parent-reported anxiety and average scan motion (i.e., frame displacement) during a social interaction fMRI paradigm in children with ASD.
Methods: To date, participants include 16 children (15 males), 11.59 ± 2.26 years, FSIQ 110.94 ± 21.45, diagnosed with ASD. The Screen for Child Anxiety Related Emotional Disorders Scale (SCARED; Birmaher et al., 1999) was administered to participants and to one of their parents. The SCARED is a validated questionnaire used as a continuous measure of childhood anxiety symptoms and includes the following factors: somatic/panic, general anxiety, separation anxiety, social phobia, and school phobia. Before entering the fMRI scanner, children received practice in a mock scanner to decrease scan-related anxiety. During the scan, participants completed an innovative social interaction paradigm, in which they believed they were chatting with a peer in real time (functional results from this experiment are discussed in another submission). Average frame displacement (FD) was calculated for each run. We conducted partial correlations between average FD and SCARED factor scores, including age and FSIQ as covariates.
Results: Results demonstrated a significant positive correlation between average FD and the parent-reported generalized anxiety factor, $r(12) = .540$, $p = .046$. In addition, there was a significant positive correlation between average FD and the parent-reported somatic/panic factor, $r(12) = .743$, $p = .002$ (see Figure 1). There were no significant correlations between child-reported anxiety factors and average FD.
Conclusions: Preliminary results suggest that parent-reported anxiety on the generalized and somatic/panic factors relate to fMRI scan motion in children with ASD. Scan motion can cause artifacts and spatial misalignment and thus the data is often excluded from research analyses. Researchers should be aware of these moderate to strong correlations between participant anxiety and scan motion, as excluding these participants from their dataset may result in a sample that is not fully representative of the ASD population. These findings are particularly relevant for paradigms examining social interactions, which may exacerbate social anxiety in participants with ASD.

21 **160.021** Executive Function in the Autism and Schizophrenia Spectrums

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Background: Autism and schizophrenia are known to have overlapping phenotypic features, including difficulties with aspects of executive function such as working memory. Overlaps between autism and schizophrenia are particularly pronounced for higher functioning individuals with autism spectrum disorders (ASD) or schizotypal personality disorder (SPD). It is not known, however, whether these shared features result from common or distinct brain mechanisms. Knowledge of the neural mechanisms involved can help inform how best to address executive function difficulties in each particular condition.
Objectives: This study aimed to characterise the neural basis of working memory in those with ASD and SPD using functional magnetic resonance imaging (fMRI), in order to explore similarities and differences in the underlying mechanisms involved in both conditions.
Methods: 76 individuals participated in the study: 24 with ASD, 20 with SPD and 32 typically developing controls. While in an MRI scanner, participants completed the n-back task as a measure of working memory. During this task, participants were presented with a sequence of letters and instructed to report whether the letter on the screen matched the one presented *n* steps earlier in the sequence. Four conditions were employed: 0-back, 1-back, 2-back and 3-back, with each condition placing an increasing load on working memory.
Results: No significant differences in activation were seen between the ASD and SPD groups. However, significantly less of an increase in activation was seen in the ASD group compared to controls as working memory load increased in a cluster which stretched from the left superior parietal lobule into the cuneus and precuneus and extended into left posterior cingulate. Significantly less of an increase in activation was seen in the SPD group compared to the control group as working memory load increased in a bilateral cluster in posterior cingulate, extending into cuneus, precuneus and lingual gyrus.
Conclusions: While the ASD and SPD groups showed slightly different activation compared to controls, there were no significant differences between the ASD and SPD groups. Those with ASD and SPD, therefore, do not appear to differ with regard to the brain mechanisms underlying working memory. These findings have implications for therapeutic interventions that target the mechanisms behind difficulties in executive function in these conditions.

22 **160.022** Exploring the Potential of Oxytocin for Enhancing Interpersonal Motor Resonance upon Direct Eye Gaze: A Transcranial Magnetic Stimulation Study

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Background: Among different social cues from the environment, the eyes constitute a very salient source for initiating social interaction or communication. Interestingly, previous work from our and other labs demonstrated that direct eye contact between two individuals can readily evoke an increased propensity to 'mirror' other peoples' actions. Particularly, using transcranial magnetic stimulation (TMS), we showed that mirror-motor mapping at the level of the primary motor cortex (M1), also known as "interpersonal motor resonance" (IMR), is significantly increased upon the observation of actions accompanied by direct eye contact, compared to the observation of actions accompanied by averted eye gaze.
Objectives: Â With the present study, we investigated the role of eye contact on IMR further, and in particular, explored whether administration of the 'prosocial' neuropeptide oxytocin (OT) can influence eye-contact induced IMR. OT is known to play an important role in promoting prosocial behavior and the perception of socially-relevant stimuli, such as eye gaze. To date however, the link between OT and IMR is less clear.
Methods: Twenty-six neurotypical adult males (18-29y) participated in a double-blind placebo-controlled cross-over design including two sessions, separated by one week. Participants were randomly assigned to receive a single dose of OT (24 IU) or placebo nasal spray at the first and second session. In each session, TMS was used to measure changes in cortico-motor excitability at the level of M1 while participants observed video stimuli of an actress performing simple hand movements combined with either direct or averted gaze. Additionally, eye tracking was performed to evaluate potential changes in spontaneous viewing behavior of the participants.
Results: At the baseline session (after PL spray), a tentative effect of eye gaze on IMR was revealed, indicating that IMR during movement observation was higher when combined with direct eye gaze, compared to averted gaze ($p=0.09$). Exploration of inter-individual variance at baseline provided indications that the effect of eye gaze on IMR was related to inter-individual variance in state attachment avoidance (State Adult Attachment Measure (SAAM)), such that - at baseline - significant modulations of IMR by eye gaze were only observed in participants with low attachment avoidance ($p=0.003$), whereas in participants with high attachment avoidance, the facilitating effect of eye-contact on IMR was absent ($p=0.50$). Strikingly however, participants with high attachment avoidance that failed to display eye contact-induced IMR enhancements at baseline were shown to significantly increase eye contact-induced IMR after a single-dose of OT ($p=0.043$).
Conclusions: Â Our results provide indications that a single-dose of OT can promote motor-mirroring of others' movements upon direct eye contact. Particularly, in participants with high attachment avoidance, OT may increase the saliency of social cues originating from the eye regions of others, which in turn may promote the propensity of an individual to automatically 'mirror' the actions and behaviors of surrounding others. Overall, these findings stimulate future investigations on the potential of OT therapy for targeting eye contact avoidance in patient populations with particular implications in this domain, such as autism spectrum disorders.

23 **160.023** Frontal Asymmetry and Reward-Based Decision Making in Children with High Functioning Autism Spectrum Disorder

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Background:
Children with autism spectrum disorder (ASD) have impairments in motivation and reward-based decision making compared to typically developing (TD) children (Dawson et al. 2005; Kohls et al. 2012; Faja et al. 2013). In a study of decision-making and goal directed behavior, researchers suggested that anxiety and other influences such as personality and temperament may be moderators of risk-taking behavior (South et al. 2011). Among TD children, temperament has been related to frontal asymmetry, but studies of frontal asymmetry in ASD have been less conclusive. Most resting state EEG studies of ASD have shown greater frontal asymmetry across alpha frequency in comparison to a TD sample (Wang et al. 2013) and within a high functioning ASD sample, individuals with greater right frontal asymmetry exhibited greater social impairment and better visual analytic skills than individuals with greater left frontal asymmetry (Sutton et al. 2005). Studying resting EEG asymmetry may offer insight on the neural underpinnings of motivational approach or avoidance in goal-directed decision making.
Objectives:
To explore the relationship between reward-based decision-making, anxiety and internalizing/externalizing behaviors, and frontal asymmetry among children with ASD.
Methods:
Participants included 48 children diagnosed with ASD and 31 IQ and age-matched TD children. Participants completed the Hungry Donkey Gambling Task, which offers insight on long-term and short-term reward-based decision-making. Anxiety, internalizing, and externalizing behaviors were reported by parents using the Child Behavior Checklist (CBCL). EEG data was recorded from a subset of 28 subjects with ASD during eyes open and eyes closed resting conditions. Frontal asymmetry between F3 and F4 was calculated from the mean alpha power found during the eyes-closed condition, as this was found to be a better measure of baseline arousal (Barry et al. 2009).
Results:
In comparison to an age and IQ-matched sample of TD individuals, we found no differences in risk taking on the Hungry Donkey gambling task with our ASD sample. Looking at individual differences within the ASD sample, we also did not find significant correlations between anxiety or internalizing/externalizing behaviors reported in the CBCL and performance on the Hungry Donkey Task or with frontal asymmetry. However, we did find a significant correlation between reward-based decision making on the Hungry Donkey task in the final two blocks and frontal asymmetry, $r(27)= -0.42$, $p<.05$.
Conclusions:
While there were no significant group differences in performance on the Hungry Donkey gambling task between groups, the correlation between risk taking and frontal asymmetry within the ASD sample poses interesting questions about frontal asymmetry as a biomarker of approach/avoidance behavior in both a social and nonsocial context. Further exploration is needed to understand this relationship, the heterogeneity of ASD, as well as group differences between ASD and TD populations. We plan on recruiting and collecting resting state EEG data from approximately 30 TD participants to compare to compare to our ASD sample. We also anticipate recruiting an additional 20 ASD participants over the coming months, which will increase statistical power across our measures.

24 **160.024** Gaze Preference and Underlying Brain Responses to Dynamic Eye Movement in Individuals with ASD Across Development

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Background: Impairments in eye contact are a notable symptom of autism spectrum disorder (ASD). Past research has shown individuals with ASD demonstrate atypical gaze responses and brain activity to passive electroencephalography (EEG) paradigms. Brain-behavior responses during dynamic social paradigms are essential to understand individuals with ASD in more ecologically valid contexts. Understanding these relationships in the context of child development is critical for the creation of clinically practicable biomarkers.
Objectives: The primary aim of the study was to explore brain-behavior relationships in ASD during an interactive social neuroscience paradigm. Specifically, this study assessed the relationship between the N170 and gaze behavior during a gaze-contingent paradigm in children and adults with ASD.
Methods: Participants included individuals with ASD (n = 78) and typically developing (TD) individuals (n = 56) matched on age (range: 8–36 years) and IQ (range of standard scores: 71–158). EEG was recorded with a 128-channel Geodesic Sensor Net, and eye-tracking (ET) was recorded with an EyeLink-1000 remote camera system. ET and EEG were co-recorded while the participant underwent a gaze-contingent viewing paradigm. Participants viewed a cross hair followed by a face. Once the participant looked at the eyes, the face responded by looking at (direct-gaze) or away from (averted-gaze) the participant. Behavioral data, time spent looking at facial features, and neural responses, N170 amplitude and latency, were collected.
Results: TD individuals looked significantly more at the left eye than between the eyes [F(1, 108) = 11.19, p < .01], while individuals with ASD did not demonstrate a gaze preference. Across groups, increased time spent looking at the left eye was associated with faster N170 response in the averted-gaze condition (r = -.222, p = .03). Gaze-condition effects were present in both groups; specifically, the N170 amplitude to direct-gaze was more negative than to averted-gaze [F(1, 108) = 6.95, p = .01)], and N170 latencies were faster in response to direct-gaze [F(1, 108) = 8.55, p < .01]. A main effect of hemisphere revealed N170 amplitudes were more negative in the right hemisphere than the left for both ASD and TD groups across conditions [F(1, 108) = 6.72, p = .01]. In the averted condition, right and left N170 amplitudes were highly correlated in the TD group (r = .47, p < .01) but not in the ASD group (r = .11, p = .37). Across groups, increasing age was related to faster N170s in the right hemisphere in the direct condition (r = -.25, p < .01).
Conclusions: This study demonstrated differences in gaze preference and brain responses to direct and averted gaze. The robust relationship between gaze and diagnostic status revealed atypical viewing patterns in ASD. Differences may be attributable to variation in cross-hemisphere connectivity as demonstrated by synchronization of the N170 amplitude in TD individuals but not those with ASD. Both groups showed developmental effects, with efficiency of gaze perception increasing with chronological age. These results add to the body of evidence supporting N170 as a promising social-communicative biomarker.

25 **160.025** Impaired Categorical Perception of Lexical Tones in Chinese Children with Autism: An Event-Related Potential Study

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Background: Previous research has shown enhanced pitch discrimination in individuals with autism in comparison with controls. While the same phenomenon was found for nonspeech stimuli in tonal-language speakers with autism, it did not generalize to the discrimination of lexical tones, which are primarily cued by pitch differences.
Objectives: It was unknown whether the abnormal pitch discrimination could be examined by categorical perception, and whether the distinct pitch processing pattern for speech and nonspeech stimuli in autism was due to a speech-specific deficit in categorical perception of lexical tones. Further it was unknown whether the categorical perception of autism could predict their pitch discrimination ability. The present study was designed to answer the above questions.
Methods: The stimuli were chosen from a 10-step lexical tone continuum used in previous CP studies (Xi et al., 2010; Zhang et al., 2012), including speech and nonspeech context. Two groups of children participated in this study: 16 children with autism, and 15 typically developing controls matched on age and IQ scores. They all completed both behavioral part and ERP part. In the behavioral part, two classical paradigm of categorical perception—identification task and discrimination task—were used to test two groups of children's perception of lexical tone in natural condition. We analyzed the accuracies of two tasks in both conditions.Â A passive oddball paradigm was adopted to examine two groups of Chinese children's Mismatch Responses (MMRs) to equivalent pitch deviations representing within-category and between-category differences in speech and nonspeech contexts.We analyzed the ERP waveforms in each condition with a traditional approach, measuring the average MMR amplitude.To further examine group-level differences in the MMRs to categorical perception of speech/nonspeech stimuli or lack thereof, neural oscillatory activities at the single trial level were further calculated with the inter-trial phase coherence (ITPC) measure for the theta and beta frequency bands.
Results: Â The behavioral results illustrated the categorical perception with autism was impaired in speech context rather than that in nonspeech context.The MMR results showed evidence for the lack of categorical perception in the lexical tone condition with an opposite trend in the harmonic tone condition for children with autism.The frequency data showed that the increased theta was induced in the between-category offering a clear phonetic identify for typically developing children in speech condition while a similar phenomenon was not found for children with autism. In the mean time, the correlation of behavioral data and ERP data was analyzed and it showed that the brain electrical signal could predict individuals' behavior to some extent.
Conclusions: Â All the data from the Chinese children with autism showed evidence for lack of categorical perception in the lexical tone condition. In view of the important role of lexical tones in acquiring a tonal language, the results point to the necessity of early intervention for the individuals with autism who show such a speech-specific categorical perception deficit.

26 **160.026** Impaired Frontal Processing in 3- to 5-Year-Old Children with Autism and a Developmental Language Delay during a Mismatch Negativity Paradigm.

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Background: The inferior frontal and superior temporal areas in the left hemisphere are crucial for language processing. Language abilities are highly variable in individuals with ASD, with difficulties that range from mild to severe impairments in pragmatics and/or social communication. Currently, language level is considered to be a continuous, rather than categorical, variable. Intriguingly, accumulating electrophysiological evidence suggests that deficits in the discrimination of rapid sound changes are associated with impaired speech processing in children with ASD. However, no previous magnetoencephalography (MEG) studies have focused on analysis of the Mismatch Field (MMF) source in young children with ASD in 3- to 5-year-old.
Objectives: The aim of this study was to investigate regional activity in the brain during a speech perception task in order to explain the phenotypic heterogeneity in language development among children with ASD.
Methods: Forty-six young TD children and 47 children with ASD participated in this study. we investigated the mismatch field (MMF) evoked by voice stimuli in 3- to 5-year-old typically developing (TD) children and children with autism spectrum disorder (ASD) using child-customized magnetoencephalography (MEG). A human voice pronouncing the syllable “ne” with a high falling tone was randomly presented as a rare deviant among frequent utterances of “ne” pronounced with a flat tone.
Results: A longer MMF latency in the left pars orbitalis in the children with ASD was associated with a lower performance in expressive language. Based on the results for the MMF amplitude, the children with ASD exhibited significantly decreased activation in the left superior temporal gyrus compared with the TD children in the 100 – 200 ms time window. If we classified the children with ASD according to the presence of a speech onset delay (ASD - SOD and ASD - NoSOD, respectively) and compared them with the TD children, both ASD groups exhibited decreased activation in the left superior temporal gyrus compared with the TD children in the 100 - 200 ms time window. In contrast, in the 200 - 350 ms time window, the ASD - SOD group exhibited increased activity in the left frontal cortex (i.e., pars orbitalis) compared with the other groups (Figure 1). For all children with ASD, there was a significant negative correlation between the MMF amplitude in the left pars orbitalis and language performance.
Conclusions: This investigation is the first to show a significant difference in two distinct MMF regions in ASD – SOD children compared with TD children; one region was independent of a speech onset delay (SOD), and the other region was dependent on SOD. The results from the first region (left superior temporal gyrus) suggested that reduced MMF amplitude in response to a change in the tone of a human voice may represent a biomarker for ASD regardless of the presence of SOD. The results from the second region (left pars orbitalis) suggested that enhanced and delayed activation in response to a change in the tone of a human voice reflects the developmental delay in language acquisition in young children with ASD.

27 **160.027** Implicit Facial Emotion Processing Abilities in Children with ASD

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Background: Social non-verbal behaviour is largely determined by efficient face processing. Individuals with autism spectrum disorder (ASD) are characterized by deficits in social communication and interaction, including difficulties in processing faces. An extensive research tradition suggests that individuals with ASD are less sensitive for socio-communicative information, and pay less attention to the eye region and more to the mouth region.
Objectives: The present study aims to examine the nature of face processing impairment in 9-to-12 year old children with ASD vs matched typically developing (TD) control children. More specifically, we investigate the subtle and implicit socio-emotional face processing abilities (i.e. facial emotion discrimination and preferential processing of the eye or mouth region) and try to delineate biomarkers that are sensitive at the individual subject level.
Methods: We use a new innovative approach where we combine scalp electroencephalography (EEG) with fast periodic visual stimulation (FPVS). The general principle of FPVS EEG is that it elicits a steady-state visual evoked potential at exactly the same frequency of visual stimulation. We present images of faces periodically at a 6 Hz base rate and we assess the sensitivity for certain socio-communicative features by periodically entering oddball images displaying changes in expression and/or identity (i.e. every 5th image; 6 Hz/5 = 1.2 Hz oddball rate). Sensitivity for these features can be assessed by quantifying the neural response at the oddball frequency. Participants have to focus on small changes in the fixation cross that is either presented on the eye region or on the mouth region.
Results: Both TDs and children with ASD display a neural response at the oddball frequency and its harmonics, and responses in both groups are reduced when the faces are inverted. Between group analyses show reduced bilateral occipito-temporal responses in ASD compared to TD. Occipito-temporal responses for both groups are higher when focusing on the mouth as compared to the eyes region.
Conclusions: With this innovative FPVS EEG method, we studied the implicit emotion discrimination abilities of children with ASD. Preliminary analyses show clear peaks at the oddball frequency and its harmonics in both the ASD and control group. Reduced neural responses in ASD, compared to controls, indicate that TDs are overall better in detecting brief changes in expression when there is no change in identity. However, these results also reveal the ability of children with ASD to implicitly discriminate between facial expressions, suggesting a quantitative difference in emotion processing abilities. Reduced responses in both groups for the inverted images indicate the presence of the inversion effect in ASD and TDs. This highly versatile EEG approach offers an objective and quantifiable index of implicit face processing abilities, reliable at an individual level, within a few minutes of time and without any complex data analyses. These analyses reveal that the technique works robustly in children and clinical populations, and elicits clear peaks at the oddball frequency and its harmonics.

28 **160.028** Influence of Autistic Traits and Social Anxiety on Gaze Patterns to Faces and Associated Neural Response

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Background: Autism Spectrum Disorder (ASD) is characterized by decreased social motivation, as well as anxiety. Both attention, measured via eye-tracking, and brain response, as measured by event-related potentials (ERP) are reliable indices of social motivation and social anxiety. The N170, a face-sensitive ERP, is slowed and attenuated in ASD; in contrast, individuals with anxiety show faster, enhanced N170s. Furthermore, while individuals with ASD show decreased attention to faces and eyes, individuals displaying social anxiety show increased attention to eyes and faces. The interplay between anxiety and ASD and attention/neural response to faces remains unexplored.
Objectives: Using EEG and eye-tracking, we examined relationships among autistic and social anxiety traits and: (1) looking patterns to neutral and fearful face stimuli; (2) brain response to faces; and (3) the relationship between these parameters and self-reported ASD symptomatology and social anxiety. We predicted that individuals with higher ratings of social anxiety symptoms would look more to the eyes, especially in the fear condition. In addition, we hypothesized that individuals with higher ratings of autistic traits would show an attenuated N170 response to faces. Those with higher anxiety were hypothesized to show an exaggerated and faster N170 to faces.
Methods: ERPs were recorded from ten neurotypical adults using 128-channel Geodesic sensor nets while eye movements were recorded concurrently with an SR eye-tracking system. Participants viewed neutral and fear faces presented in random sequence for 5 seconds. ERPs were segmented to the onset of the face and to subsequent fixations. Eye-tracking variables included dwell time in specified ROIs (eyes, left/right eyes, between eyes, mouth, and nose) fixation duration, and dispersion. Social anxiety traits and autistic traits were quantified through self-report questionnaires (Social Avoidance and Distress Scale [SAD]; Autism Quotient [AQ]; Social Responsiveness Scale [SRS]). Data collection is ongoing.
Results: Preliminary results indicate that earlier N170 latency is significantly correlated with higher scores on the AQ (fear condition: r= -.824, p= .003; neutral: r= -.838, p=.002), SAD (neutral condition: r= -.690, p= .027), and SRS (fear condition: r=-.828, p= .003; neutral: r=-.843, p=.002). Ongoing analyses of visual gaze data and fixation-related ERPs during free-viewing of faces will reveal relationships among anxiety and social function, neural response, and gaze.
Conclusions: Initial results reveal relationships among measures of both autistic traits and social anxiety and N170 latency. The hypothesis that those with more social anxiety traits would have faster N170 responses was supported; contrary to our predictions, autistic traits were also associated with decreased N170 latency. These findings may reflect hypervigilance and associated increased efficiency of neural response in individuals with higher levels of anxiety. These results indicate mutual influence of subthreshold ASD and anxiety on ERP indices of social perception.

29 **160.029** Interactive Social Neuroscience to Assess Resting State Brain Activity in the Broad Autism Phenotype

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Background: Autism Spectrum Disorder (ASD) is hallmarked by interpersonal difficulties, yet there is limited research examining brain activity during actual social interactions. To investigate this issue, this study utilized interactive social neuroscience methods to examine alpha oscillations (8-11 Hz) measured with electroencephalography (EEG) in social context and associations between brain activity and autistic traits in typically developing (TD) pairs of adults.
Objectives: Â Characterize neural markers of resting brain activity during an interpersonal interaction and their association with autistic traits in a social context.
Methods: Â 16 TD adults, grouped in same-sex dyads, sat quietly for two minutes with their eyes opened (EO) and eyes closed (EC) in three conditions: (1) “separate” rooms, (2) the same room with their “backs” to each other, and (3) the same room while “facing” each other. EEG was simultaneously recorded from each member of the dyad using wireless recording devices. The Autism Quotient (AQ) was administered to quantify social function and dysfunction.
Results: For alpha power at frontal sites, a significant interaction between condition (separate, back, facing) and eyes (EO/EC) was detected (p=.017). Post-hoc paired samples t-tests indicated: (1) EO elicited greater alpha power than EC in the separate condition but not in back or facing conditions (p=.040); and (2) in the EO condition, greater alpha power in the separate condition than in the back condition (p=.040). Analysis then examined alpha power in each individual frontal electrode; only significant findings are reported. There was a main effect of eyes at left frontal (FL; F(1,12)=5.864, p=.032), Fz (F(1,12)=6.810, p=.023), and right frontal (FR; F(1,12)=5.748, p=.034) sites. There was also a main effect of condition at FL (F(1.1, 13.4)=5.404, p=.033), Fz (F(1.2,15.2)=6.969, p=.014), and FR (F(1.3,15.3)=6.268, p=.018). Pairwise comparisons revealed greater alpha power in EC than EO in FL (p=.032), Fz (p=.023), and FR (p=.034), as well as attenuated alpha power in facing compared to back (FL, p=.013, Fz, p=.044) and separate (FL, p=.021; Fz, p=.010; FR, p=.014) conditions. Further, the difference in alpha power between separate and back with EO in FL (p=.015) and separate and facing with EO in FR (p=.048) was correlated with the attention switching subscale of the AQ. Additionally, scores on the attention to details subscale of the AQ were associated with the difference in alpha power between separate and back conditions with EC in FL (p=.011) and FR (p=.002) and separate and facing conditions with EC in FL (p=.023) and FR (p=.018).
Conclusions: This study applied interactive social neuroscience to investigate the relationship between autistic traits and resting EEG activity during varying levels of interpersonal interaction. Results reveal that the presence of another person modulates resting brain activity. Individuals with lower levels of autistic traits exhibited greater alpha power when resting separately compared to when resting with another person, suggesting greater sensitivity to the presence of another person. Our findings provide new insight into modulation of resting state brain activity through the presence of another person and emphasize the importance of utilizing more ecologically-valid approaches in neuroscientific studies of social brain function.

30 **160.030** Modulation of Brain Activation and Serotonin during Sustained Attention in Autism Using Tianeptine

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Background: Prior research has demonstrated abnormal brain activation during sustained attention in individuals with autism spectrum disorder (ASD). The neurobiological basis for this is unknown but the serotonergic system may play a key role. For example, hyperserotonemia has been frequently reported in ASD; and we demonstrated that reducing serotonin by acute tryptophan depletion (ATD) modulates abnormalities in brain function. However, ATD cannot be easily used in clinical settings. Hence, investigating the modulating role of an existing drug that reduces serotonin may shed light on a novel treatment opportunity with the potential to be rapidly translated into the clinic.
Objectives: To test the effect of the selective serotonin reuptake enhancer (SSRE), tianeptine, on sustained attention networks in ASD.
Methods: We included 19 right-handed adult males with ASD (diagnosed using the ADI-R and ADOS) and 19 age- and IQ- matched control subjects. Pharmacological magnetic resonance imaging (phMRI) was used to compare brain activity during a parametrically modulated sustained attention task under an acute dosage of 12.5 mg tianeptine and placebo in a randomised, double blind procedure. The phMRI data were analysed using a nonparametric approach (c.f. http://brainmap.it) and significance was defined as p <.05 (corrected for multiple comparisons).
Results: Individuals with ASD had significantly decreased activation under placebo in regions involved in regulating sustained attention - including right caudate, right thalamus, left precentral gyrus and left middle frontal gyrus. In contrast they had increased activation in left insula and right middle temporal gyrus. After tianeptine administration brain activation in individuals with ASD was modulated towards control placebo levels in brain regions that mediate sustained attention - including right thalamus, right caudate, right middle temporal gyrus, left precentral gyrus, left middle frontal gyrus and left insula.
Conclusions: Our findings provide first evidence that serotonergic modulation with an SSRE can 'normalise' brain activation during sustained attention in adults with ASD. This is now being 'translated' to the clinic to establish whether tianeptine is an effective symptomatic treatment for some individuals with ASD.

31 **160.031** Motor Cortex Inhibition in Youth with ASD and Co-Morbid ADHD a Marker for Clinical Executive Functioning

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Background: Individuals with a co-diagnosis of ADHD and co-morbid ASD are reported to have higher rates of hospitalization, medication treatment, and behavioral therapy than ASD alone [1]. In addition, youth with dual diagnosis have therapeutic implications including distinct treatment and neural correlates [2, 3]. Currently, there lack of an objective methodology for the diagnosis and management of ASD+ADHD , especially in regards to pharmacotherapy response. Previously, we have demonstrated that a transcranial magnetic stimulation (TMS) evoked measure, short-interval cortical inhibition (SICI) has been associated with ADHD diagnosis and severity [4]. SICI is a TMS measure of the efficiency of inhibitory interneurons in the primary motor cortex (M1) [5].
Objectives: To measure resting paired pulse TMS evoked cortical inhibition (SICI) and determine the relationship between SICI and executive functioning deficits in youth with ASD and co-morbid ADHD.
Methods: Baseline TMS measures of youth with ASD and co-morbid ADHD currently enrolled in a double-blind placebo controlled randomized control trial examining physiological effects of a single dose methylphenidate was analyzed for association with clinical severity of the Connors-3 Parent Rating Scale rating scale. The modulus of TMS motor evoked potentials by surface electromyography of the dominant hand was used as the primary outcome.
Results: Â The dataset included 13 male subjects with ASD with a mean age of 15 (SD 2.8, range 11 to 20). As expected, significant inhibition of MEP modulus was demonstrated with a 3 ms subthreshold paired pulse (M=0.008; SD=0.010) compared to single pulse TMS (M=0.011; SD=0.009) t=3.916, p < 0.001). There was a correlation between SICI and Connor's total executive functioning score (Figure 1; r=-0.578, n=13, p=0.039). A trending relationship was identified between SICI and the total Connor's score (r=-0.518, n=13, 0.070).
Conclusions: We identified preliminary data suggesting that a TMS measure of motor cortex inhibition is significantly associated with a well-validated behavioral measure of executive function. As a quantitative physiological marker of motor function that can be obtained quickly, SICI is an ideal candidate which to clarify fundamental mechanisms of cerebral function that underlie impaired behavioral control.
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32 **160.032** Movement during MR Scanning in Children with Autism Spectrum Disorder

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Background: GABA levels, measured with edited MRS, are reduced in children with Autism Spectrum Disorder (ASD). Long scan times are needed to obtain a sufficiently high signal-to-noise ratio (SNR) to quantify GABA reliably. SNR increases with scan duration but suffers from motion and frequency drift. Measurements in neurological pediatric cohorts can be difficult and understanding the pattern of movement, in particular *when* children move, might benefit the design of future imaging studies and optimize the trade-off between scan time and SNR.
Objectives: To assess the movement behavior of children with and without ASD during edited MRS of GABA.
Methods: Volunteer and parental consent was obtained under local IRB approval. *Eligibility*: Children with ASD met DSM-V diagnostic criteria, confirmed using the Autism Diagnostic Observation Schedule-Version 2 (ADOS-2). All typically developing children (TDC) were free of criteria for psychiatric disorders based on the Diagnostic Interview for Children and Adolescents. Data were acquired in 21 children with ASD and 20 TDC with normal IQ (8–12 yrs). *Imaging*: GABA-edited MR spectra were acquired from a 27 mL voxel over the right primary sensorimotor area using MEGA-PRESS on a 3T Philips Achieva scanner (Philips Medical Solutions) (320 transients; scan time = 10 min). Children watched a movie during scanning. *Analysis:Â* The frequency of the suppressed water signal in each transient (frame) was extracted for both groups using Gannet 2.0. The step size between each frame was calculated and a frequency step over 2 Hz (0.016 ppm) was defined as a motion event. Differences in movement behavior in the two groups were assessed in terms of (i) size and number of movements and (ii) correlation with time point of movement (i.e., are children more likely to move near the beginning or end of the scan?).
Results: Â Figure 1 shows a histogram of movement frequency among the cohort, as well as accumulative percentages. Movement frequency increased significantly throughout the scan (frames binned into groups of 10) across all children (Fig 2; R = 0.56), but more in ASD (R = 0.54) than in TDC (R = 0.3) although this was not significantly different (Fisher R-to-Z, p = 0.38). While no differences were shown in movement frequency, children with ASD had larger movements (4.8 ± 5.1 Hz) compared to TDC (3.4 ± 1.2 Hz), although not significantly (p = 0.3).
Conclusions: These data show that children with ASD do not show more movements than TDC during MRS scanning. These results are important in establishing that previously reported GABA differences are not driven by movement. More children with ASD show *no* movement behavior (ten without movement versus five for TDC, Fig 1). There were no significant differences in the size of movement. Importantly, children are more likely to move near the end of a 10-min scan so while shorter scans (e.g. 7 minutes instead of 10) may impact SNR, they may benefit from reduced movement related artefacts. Near-end-of-scan motion should be taken into account when planning MRS experiments, as well as prospective frequency and motion-correction.

33 **160.033** Neural Correlates of Hearing One's Own Name and Others' Names in Adults with Autism Spectrum Disorder

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Background:
Autism spectrum disorder (ASD) has been linked to a different 'sense of self' from its very first descriptions, and studies indeed suggest altered self-referential processing in ASD. Infants later diagnosed with ASD often fail to respond to their own name (Zwaigenbaum et al., 2005), which has been argued to be a trait of the broader autism phenotype (e.g., Nadig et al., 2007). Surprisingly, as of yet, no published study has looked at neural correlates of hearing one's own name in adults with ASD. In a recent ERP study (Cygan, Tacikowski, Ostaszewski, Chojnicka, Nowicka, 2014), neural responses to visual presentation of their own versus other people's names were investigated in adults with ASD and neurotypical controls. P3 amplification was observed for seeing one's own name (versus other names) in controls, while this effect was absent for adults with ASD, suggesting a self-referential processing deficit.
Objectives:
As we reasoned that investigating hearing one's own name in ASD may be more ecologically valid than seeing one's own name, we evaluated for the first time ERP responses to hearing one's own name versus others' names in adults with ASD and neurotypicals. We hypothesized a P3 enhancement for own name versus others' names in neurotypicals, and this effect to be absent or diminished in adults with ASD.
Methods:
Participants (ASD group: N = 24; neurotypical group: N = 23) performed an auditory oddball task, while their EEG was being recorded using 64 electrodes. Each participant was presented with 5 different sound conditions: standard sounds (66%, 198 trials), target sounds to which they had to respond (4%, 12 trials) and three task-irrelevant name conditions: own name, name of close other, unfamiliar name (each 10%, 30 trials).
Results:
A familiarity effect appeared at the frontocentral N1, with larger amplitudes for one's own name and the name of a close other than an unfamiliar name. Groups did not differ with respect to this effect. The amplitude of an early P3 subcomponent with a central topography (P3a) was found to be enhanced for hearing one's own name versus the name of a close other in the neurotypical group, indicating a self-referential effect. However, as hypothesized, this effect was lacking in adults with ASD.
Conclusions:
ERPs showed an early familiarity effect at the N1, and a self-referential effect at the P3. Processing of familiarity was found to be intact in adults with ASD. However, adults with ASD were specifically impaired in self-referential processing as the typical P3a amplification for one's own name as seen in neurotypicals was absent in adults with ASD. Hence, our findings indicate diminished self-referential processing of a highly familiar self-related stimulus, namely one's own name, in adults with ASD, which may have a serious negative impact on everyday social interaction.

34 **160.034** Neural Correlates of the Pupillary Light Reflex in the Broader Autism Phenotype

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Background: Autism spectrum disorder (ASD) is characterized by early emerging deficits in social communication and restricted/repetitive behavior. In addition to these core symptoms, individuals with ASD often exhibit atypical arousal regulation. As the locus coerulus (LC) has numerous projections throughout the central nervous system, with norepinephrine (NE) acting as the main neurotransmitter, the LC-NE system has been linked to arousal and attention. The LC-NE system is thought to be indexed by the pupillary light reflex (PLR) because the LC releases NE to control pupillary dilation. Adolescents with ASD exhibit a hyposensitive PLR (Fan et al., 2009); however, infants at high risk for ASD display a hypersensitive PLR (Nystrom et al., 2015); thus, the developmental trajectory of the PLR remains unclear. Finally, while the PLR itself is well characterized, associated neural response and relations to social function are poorly understood.
Objectives: To investigate relationships among PLR, electrophysiological brain correlates, and subthreshold autistic traits.
Methods: Pupil data were collected on an Eyelink-1000 system, and simultaneous EEG recording was collected with a 128-channel Hydrocel Geodesic Sensor net. Stimuli consisted of a white central fixation on a black background, which flashed white for approximately 75 ms. Participants viewed 50 consecutive trials of PLR. EEG data were decomposed and power was computed for the delta (2-4 Hz), theta (4-8 Hz), and alpha (8-13 Hz) frequency bands. Four regions of interest were created by averaging across channels: left frontal, right frontal, left posterior, and right posterior. Characteristics of the PLR were extracted from averaged trials. Autistic traits were measured with a self-report measure, the Broad Autism Phenotype Questionnaire (BAP-Q).
Results: Preliminary analyses of 10 subjects (data collection is ongoing) revealed that subjects with higher scores on the BAP-Q rigidity scale exhibited faster PLR (r -.653, p=0.041). Higher scores on the BAPQ Pragmatic score significantly correlated with slower constriction velocity (r=-.665, p=0.036). Greater pupil constriction was associated with increased power in the right frontal delta band (r=.909, p=.001). Decreased theta power in the right posterior was associated with increased impairment on the BAP-Q pragmatic language scale (r=-.747, p=.021), as well as decreased pupil constriction (r=.776, p=.014).
Conclusions: In the current study, autistic traits related to rigidity were associated with hypersensitive PLR; in contrast, autistic traits related to pragmatic language difficulties displayed a hyposensitive PLR. These distinctions suggest that previous discrepant results may be due to developmental effects, with rigidities being more active in infancy and pragmatic language becoming more focal in subsequent development. Moreover, variance in autistic traits and PLR were associated with oscillatory brain activity. These results shed light on the relationships between subcortical regions supporting arousal, cortical EEG, and social functioning, providing insight into mechanisms relevant to the development of targeted interventions and personalized medicine.

35 **160.035** Neural Fingerprints of Behavioural Rigidity in Autism

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Background: Recent literature on behavioural rigidity in autistic individuals has suggested that this core symptom might be associated with difficulties in generating task intentions. Empirical evidence for this idea comes from experimental designs in which participants were not only required to switch between two simple cognitive tasks but were also instructed to deliberately choose which of the two tasks to perform next. These voluntary task-switching (VTS) studies revealed that compared to their neurotypical (NT) peers, autistic individuals have a generally stronger tendency to continue repeating tasks (i.e., increased *repetition bias*) and that once they decide to switch tasks, their performance declines more (i.e., increased *switch costs*). These observations are considered to reflect behavioural rigidity of autistic individuals within experimental settings.
Objectives: The current study was developed to follow on this line of research, and its main objective was to specify the neural fingerprints of behavioural rigidity in autistic individuals as reported in the VTS studies.
Methods: Participants were 31 autistic individuals and 32 NT controls, matched on their age and IQ. They were instructed to choose between two simple cognitive tasks at the beginning of each trial. The tasks included responding to the location or responding to the shape of the presented stimuli. The participants pressed a spacebar to indicate that the choice had been made, which triggered the stimulus presentation. They were then required to respond to either the stimulus location or the stimulus shape, dependent on their task choice for that trial. Using this VTS paradigm, we could investigate the intentional component (task choice) separately from its implementation at the level of task execution (responding to the presented stimulus). We recorded their task choices, as well as their subsequent responding to the stimuli in terms of reaction times (RTs) and error rates. Importantly, the corresponding brain activity was measured with electroencephalography (EEG). The EEG markers of interest were the preparatory contingent negative variation at frontal sites (CNV) as a marker of (the formation of) task intentions and the stimulus-locked P3 at centro-parietal sites as a marker of stimulus-related task execution.
Results: Our behavioural findings replicate previous observations of a significantly stronger repetition bias and significantly larger switch costs in terms of RTs in autistic participants. Crucially, they demonstrated a significant attenuation of the CNV, which is typically associated with a weaker intentional task preparation. However, no significant differences in the latency or peak amplitude of the P3 were observed between the groups. Specifically, the P3 component demonstrated a usually reported attenuation in switch trials compared to repeat trials, with this pattern being similar in both groups.
Conclusions: Our results imply that the way in which global task intentions are formed differs between autistic individuals and their NT peers. The way that tasks are actually being executed seem to differentiate only at the behavioural level. Altogether, the present study suggests that the tendency of autistic individuals to engage in repetitive behaviours is associated with the formation of task intentions when tasks are chosen voluntarily.

36 **160.036** Neural Signature of Dynamic Facial Processing in Children with ASD

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Background:
Faces are highly complex visual stimuli and fundamentally dynamic; thus, interpretation of facial movement requires frequent updating of visual representations in tandem with higher-order integration of social knowledge (Jemel et al., 2006; Webb et al., 2010; Naples et al., 2015). Impaired interpretation of facial expression is a striking social deficit that has been commonly observed among children with autism spectrum disorder (ASD; Mottron et al., 2006; Webb et al., 2010; Webb et al., 2012). EEG mu rhythm attenuation has been associated with infants' response to emotional facial motion (Rayson et al., 2016), as well as understanding and interpretation of others' actions more generally (Muthukumaraswamy & Johnson, 2004). Prior research indicates that children with ASD demonstrate atypical mu rhythm attenuation when attending to dynamic social information (i.e., biological movement; Bernier et al., 2007; Hudac et al., 2015), although findings are inconsistent (Oberman et al., 2012; Bernier et al, 2013). However, little is known about this neural signature during the observation of dynamic facial expressions in ASD.
Objectives:
The focus of current work is twofold: 1) to examine spectral power in the mu rhythm during the observation of dynamic facial information perception in ASD and 2) to extend our understanding of this neural activity to social behavior.
Methods:
Children with ASD (*n*=37, *M*=11.6, *SD*=3.24) and typically developing (TD) children (*n*=42, *M*=11.5, *SD*=2.21) participated in an EEG study during which they were presented with photorealistic, computer-generated faces. As reported in Naples et al. (2015), the faces consisted of fearful movement and affect free movement (puffed cheeks). Power spectra relative to resting baseline across scalp electrode clusters surrounding C3 and C4 were averaged across trials for each condition. Following Bernier et al. (2013), mu attenuation was calculated as the log of the ratio of power in 8-13 Hz during observation over power in the same frequency range during resting baseline for each individual. Data collected from the Benton Facial Recognition Test (BFRT, Benton, 1983) and the Reading the Mind in the Eyes Task – Revised (RMET-R; Baron-Cohen et al., 2001) served as social behavior outcomes.
Results:
Univariate ANOVA indicated that both groups displayed mu attenuation in response to dynamic facial movement relative to a resting state baseline. However, there was no significant effect of group (p=.196) or condition (p=.654) on mu attenuation. Consistent with previous literature, one-way ANOVA indicated that children with ASD scored significantly lower (2.46 points) on the RMET-R [F(1,77)=11.57, p=.001]. Group differences were not observed on the BFRT (p=.09).
Conclusions:
Despite group differences in behavioral measures of social information processing based on observation of static images of emotionally expressive eyes in ASD, as indexed by the RMET-R, children with ASD and TD in this study exhibited similar patterns of mu attenuation in response to facial movement. These results concord with previous research failing to find differences in mu attenuation across diagnostic groups, extending these results to the perception of dynamic facial movement.

37 **160.037** Probing Visual Correlates of Excitatory/Inhibitory Imbalance Using EEG: A Transdiagnostic Study in ASD and Schizophrenia

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Background: Excitatory/inhibitory imbalance is a mechanistic theory posited to explain dysfunction in both autism spectrum disorder (ASD) and schizophrenia (SCZ). In visual cortex, excitatory/inhibitory balance underlies surround suppression effects, in which neural response to a central stimulus is suppressed when it is surrounded by parallel stimuli but facilitated when it is surrounded by perpendicular stimuli. By assessing suppression of neural response in the context of parallel vs. perpendicular surround, this study provides a direct probe of the excitatory/inhibitory imbalance hypothesis across disorders.
Objectives: This study aimed to (i) evaluate an event related potentials (ERP) index of surround suppression in adults with ASD and schizophrenia and (ii) examine transdiagnostic associations between neural response and social and perceptual difficulties.
Methods: Participants included 14 adults with ASD and 12 with SCZ. EEG data was recorded using a 128-channel sensor net. Participants observed vertical sinusoidal gratings filling a central annulus, either alone, surrounded by gratings that were perpendicular, or surrounded by parallel gratings (Fig.1). With intact surround suppression, attenuated ERP amplitudes are expected to parallel vs. perpendicular surround. To maintain attention, participants pressed a button when a central fixation turned green; these trials were discarded from analysis. EEG data was preprocessed off-line, and the P50 and N1 components were extracted over occipital scalp (Oz). Participants completed the Social Responsiveness Scale (SRS), Schizotypal Personality Questionnaire (SPQ), and Sensory Gating Inventory (SGI). Between-group differences were examined with repeated measures ANOVAs (DVs: P50 and N1 mean amplitude, 40-60ms and 75-125ms after stimulus onset, respectively). Transdiagnostic associations between neural response to perpendicular versus parallel surround and self-report of social and perceptual difficulties were explored with bivariate correlations.
Results: For the P50, there was a significant main effect of Group (F=4.41, p=.046) such that P50 amplitude was attenuated in ASD vs. SCZ across conditions. There was no main effect of Condition and no Condition by Group interaction (ps>.26), indicating that neither group showed significant suppression of the P50 response with parallel surround (Fig.2). For the N1, there was a marginally significant main effect of Condition (F=4.04, p=.056), wherein N1 amplitude was attenuated to parallel vs. perpendicular surround across groups; however, there was no significant interaction or main effect of Group (ps>.26). Across ASD and SCZ, suppression of N1 response was not associated with self-report of ASD symptoms on the SRS. However, reduced N1 suppression was associated with greater levels of symptoms on the SPQ ideas of reference scale (r=-.688, p=.04). Stronger N1 suppression was associated with greater fatigue and stress vulnerability with sensory input on the SGI (r=.578, p=.039).
Conclusions: Here, we show evidence for surround suppression in both ASD and SCZ in the N1 response to parallel versus perpendicular surround that does not differ by diagnostic category. Instead, strength of suppression mechanisms related to perceptual delusional beliefs and behavioral experience with sensory stimuli, transdiagnostically. These findings support a dimensional (RDoC) approach to understanding the extent and impact of excitatory/inhibitory imbalance in ASD and related disorders.

38 **160.038** Reduced Frontal P1 Amplitude Differentiation As a Neural Signature of Speech Sound Disorder in ASD

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Background: Auditory statistical learning supports acquisition of language and social skills and is therefore of particular interest in autism spectrum disorder (ASD). The extant literature is inconclusive regarding the role of statistical learning in language deficits associated with ASD. Prior research on this topic has been limited by inclusion of only high functioning individuals and reliance on explicit measurement of this implicit process (e.g. Mayo & Egsti, 2012). Moreover, the heterogeneity of the ASD phenotype has potential to mask patterns of neurodevelopmental differences among clinical subgroups. The P1 event related potential (ERP) is an index of auditory cortical development (Sharma et al., 2005) that can be measured during passive statistical learning tasks, and thus has potential as a marker of disrupted, bottom-up processing of auditory information in ASD.
Objectives: The current study aims to characterize the P1 ERP component in youth with ASD in the context of auditory statistical learning. We hypothesize that the ASD group will have more difficulty encoding and recognizing auditory stimuli, as evidenced by reduced frontal P1 differentiation between learned and unlearned sequences of speech-like sounds. Additionally, we expect that within the ASD group, weaker frontal P1 differentiation will be associated with a profile of lower verbal IQ, verbal memory deficits, and impaired speech production.
Methods: 102 youth with ASD (n=58), comorbid ASD and speech sound disorder (ASD+SSD; n=12), or no neurodevelopmental diagnosis (n= 32) ages 7 to 17 years (mean = 12.74) participated in electroencephalogram (EEG) testing as part of two larger studies of ASD. ASD and comorbid diagnoses were established by trained clinical professionals following a clinical evaluation that included thorough clinical interview, cognitive and behavioral assessment. ERPs were measured during an eight minute, passive, auditory word segmentation task. During an initial exposure period, participants listened to streams of nonword syllabic phonemes. This was followed by a test phase wherein both novel and previously heard tri-syllabic combinations were randomly presented across 48 trials.
Results: Results of the two-level, repeated measures analysis are presented in Table 1. Auditory statistical learning in the test phase was evidenced across the entire sample by a significantly stronger mean frontal P1 amplitude response to the learned versus unlearned stimuli. Age attenuated this effect, with older youth demonstrating smaller differences between stimuli and weaker mean amplitudes overall. Contrary to expectations, ASD diagnosis, verbal IQ and verbal memory did not moderate the effect. However, ASD+SSD youth did show significantly weaker differentiation between learned and unlearned stimuli, indicating impaired auditory statistical learning within this clinical subgroup.
Conclusions: Increasingly, research on ASD is emphasizing the heterogeneity of the disorder, including variability in psychiatric comorbidity. In the current study, abnormal frontal P1 amplitude is identified as a neural signature of comorbid ASD + SSD. The results are consistent with a deficit in bottom-up processing of auditory input that affects encoding and reproduction of speech sounds, but may also be consistent with a bi-directional effect, wherein poor speech production impairs refinement of specialized neural circuits that support phonemic awareness.

39 **160.039** Residual Relationships Between Motion and Bold Activity Remain after Preprocessing

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Background: Head motion is known to influence the BOLD fMRI signal, but its effects are not yet fully understood. Certain techniques, such as functional connectivity MRI (fcMRI), are particularly sensitive to motion, which has been shown to spuriously affect conclusions in studies comparing groups that differ in movement characteristics (Power et al., 2012; Deen & Pelphrey, 2012; Tyszka et al., 2014), such as controls and individuals with ASD. Many data cleanup practices (e.g. censoring/"scrubbing") require considerable loss of data, and might not fully eliminate residual motion influences (Burgess et al., 2016). Thus a further characterization of the influences of motion on the BOLD signal is needed.
Objectives: To develop new methods to quantify relationships between head movement and BOLD activity, and assess whether current cleanup methods adequately account for movement-related effects on the BOLD signal.
Methods: We analyzed two datasets. (1) Two 16-minute resting state fMRI scans (TR=813ms) from 29 adolescent and adult controls and 24 matched individuals with ASD collected at Indiana University. (2) Two 14-minute resting state scans (TR=720ms) from 75 unrelated Human Connectome Project participants (Van Essen et al., 2013). Both datasets were preprocessed nearly identically using state-of-the-art cleanup methods (ICA-FIX; Salimi-Khorshidi et al., 2014; Smith et al., 2013). Dataset 1 was also alternatively preprocessed using conventional motion and nuisance regression (with and without global signal). We developed a new analytic method for assessing residual movement-linked BOLD artifact, both at the individual and group level, by quantifying the relationship between movement severity and subsequent BOLD activity.
Results: We found that movements are systematically linked with structured and prolonged changes in the BOLD signal that depend on the severity of the preceding motion. This relationship was not limited to high movement epochs; in fact, remarkably small movements were linked with structured BOLD changes occurring considerably later in time. Nearly all motion magnitudes (including those well below typical censoring thresholds) were associated with structured BOLD changes extending as far as 30s later; for some larger motions, over 50s later. Effect sizes of motion-linked BOLD changes were largest at approximately 6s and 20s following motion. These patterns were replicated in 4 independent sessions from two different scanners and persisted robustly across multiple preprocessing methods, but were not observed in four different null models. Note that scrubbing procedures cannot eliminate these temporally distant BOLD changes, as they persist much later than typical temporal masking (e.g. over 5-10 TRs post-motion).
Conclusions: We provide a novel description of systematic and temporally far-reaching influences of motion on the BOLD signal, supporting previous case reports (Power, 2016; 2014). These influences are not yet adequately handled by state-of-the-art preprocessing methods, and have the potential to artifactually influence results of fcMRI studies that compare groups differing in motion characteristics. Characterizing this pattern is a critical first step in developing new methods that can address it appropriately. Our results suggest caution in interpreting the meaning of different patterns of functional connectivity between ASD and controls until we better understand the interaction between motion and the BOLD signal.

40 **160.040** Resting State EEG and Sensory Responsivity in ASD and Schizophrenia

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Background: Many individuals with autism spectrum disorder (ASD) report and display atypical sensory experiences and responses. These manifest heterogeneously: individuals experience both hyper- and hyposensitivity to different sensory modalities and react with both sensory-avoidant and sensory-seeking behaviors. Similar experiences are frequently reported by individuals with schizophrenia spectrum disorders (SZ) and are endorsed by many typical adults, suggesting that sensory features associated with ASD vary continuously throughout the population. The mechanisms underlying the heterogeneity of sensory profiles in individuals with and without ASD are poorly understood; the study of these mechanisms will inform basic understanding of sensory responsivity and guide clinical response to sensory sensitivities and behaviors that impact quality of life in multiple clinical populations.
Objectives: This study examines (a) relationships between EEG power spectra and individual differences in sensory responsivity and (b) whether these relationships differ among individuals with ASD, SZ, and TD adults.
Methods: Resting EEG data were acquired from 33 adult participants (enrollment ongoing; ASD: n=18,13 male; SZ: n=10 9 male; TD: n=5,3 male) using a 128-channel net. Power spectra for delta, theta, alpha, beta, and gamma frequency bands were generated for frontal, temporal, parietal, posterior, and midline regions of the cortex from 2-second segments of EEG data. Sensory sensitivity and responsivity were evaluated using the Glasgow Sensory Questionnaire (GSQ), a 42-question self-report questionnaire that quantifies hypo- and hypersensitivity in 7 sensory modalities.
Results: Â Principal components analysis identified a single component accounting for the majority of variance in the GSQ's subscales, so preliminary analyses examined participants' total scores on the measure. Multiple regression results showed that diagnostic group (ASD/SZ) and GSQ score were significant independent predictors of higher left and right temporal delta power (*left*: ASD, β=140.46, p<0.001; SZ, β=165.58, p<0.001; GSQ, β=4.96, p<0.001; *right*: ASD, β=129.01, p=0.005; SZ, β=148.3, p=0.007; GSQ, β=4.338, p=0.0012). While higher GSQ scores were associated with higher temporal delta power in TD controls, they were associated with lower delta power in participants with ASD or SZ (*left*: ASD:GSQ, β=-5.13, p=<0.001; SZ:GSQ, β=-4.95, p=0.001). This pattern was also seen in the right parietal region: delta power increased with GSQ score in TD controls, and decreased with GSQ score in participants with a diagnosis of ASD or SZ (GSQ, β=3.47, p=0.017; ASD:GSQ, β=-4.05, p=0.009; SZ:GSQ, β=-3.878, p=0.017). Midline gamma (30-80 Hz) power showed significant effects of schizophrenia diagnosis and GSQ score independently, as well as interactions between GSQ and diagnosis of either ASD or SZ (SZ, β=-3.08, p=0.013; GSQ, β=-0.07, p=0.01; ASD:GSQ, β=0.07, p=0.015; SZ:GSQ, β=0.096, p=0.004), suggesting that midline gamma power decreased with higher score on the GSQ in TD controls and increased with GSQ score in participants with SZ, staying constant in participants with ASD.
Conclusions: Neural oscillations in specific regions and frequency bands varied with sensory sensitivity and responsivity; associations between the power in these spectra and sensory sensitivity were modulated by diagnosis of ASD or schizophrenia in a direction opposite of that observed in TD participants. These results suggest common neurological mechanisms underpinning atypical sensory processing and response in ASD and SZ.

41 **160.041** Resting-State Theta Oscillations Predict Executive Functioning Deficits in Children with Autism Spectrum Disorder

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Background: Â Children with autism spectrum disorder (ASD) often show deficits in executive functioning (EF), the ability to manage complex or conflicting information to achieve a goal. EF deficits in ASD may be associated with impaired prefrontal activity and functional integration with the rest of the brain (O'Hearn et al., 2008). In particular, resting-state theta oscillations have been suggested to play a general integrative role in the organization in brain activity, and are particularly important for EF domains that require a variety of cognitive processes such as working memory and inhibitory control (Sauseng et al., 2010). There is significantly greater resting-state theta power in individuals with ASD in the frontal and parietal regions (Wang et al., 2013; Cornew et al., 2013). Taken together, prior research suggests that resting theta oscillations in children with ASD may be a possible neural system abnormality that underlies EF deficits. To our knowledge, associations between resting theta oscillations and EF deficits within children with ASD have not yet been explored.
Objectives: To examine whether frontal and parietal resting-state theta oscillations predict EF deficits in children with ASD.
Methods: 28 children with ASD (M = 114 months, SD= 13.53) provided adequate EEG data with data collection still underway. EEG was recorded during both eyes-closed and eyes-open resting conditions. To compute power spectra, 2 minutes of EEG were divided into intervals of 2-seconds. A Hanning window and a Fast Fourier Transformation were applied. Children also completed a Flanker task as a measure of inhibition, and EEG was recorded and analyzed for the N2 event-related potential. Parents completed the Behavioral Rating Inventory of Executive Function (BRIEF), which measures global EF skills as well as specific domains of EF.
Results: Linear regressions controlling for age, gender and IQ examined the relation between theta power and EF deficits. Lower frontal theta power during eyes-open condition predicted worse working memory (β = -0.54, t(16) = -2.20, p = 0.04) and planning/organization (β = -0.56, t(16) = -2.77, p = 0.02) on the BRIEF. With eyes open, reduced parietal theta power predicted increased N2 amplitude during incongruent trials (β = -0.38, t(15) = -3.00, p = 0.01) but faster reaction times during the flanker task (β = -0.55, t(15) = -2.68, p= 0.02).
Conclusions: These results suggest that resting theta oscillations predict EF deficits in children with ASD and provide some preliminary evidence that individual differences in the resting-state neural systems in children with ASD may be associated with task-dependent activation in the brain during EF tasks. However, increased theta in both frontal and parietal regions predict *better* EF performance. This is surprising given that decreased theta power during resting is correlated with better cognitive performance in a typically developing sample (Klimesch, 1999). The relation between parietal theta and increased N2 amplitude suggests there may be an association between decreased theta power during rest and increased anterior cingulate cortex activation during the flanker task. We plan to examine these associations in a typically developing sample, and compare resting-state theta power between groups.

42 **160.042** Sensory Characteristics and Autistic Traits Influence Neural Responsivity to Predictable Versus Unpredictable Visual Information

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Background: Hypo- and hyper-sensory response and preference for predictability are common features of autism spectrum disorder (ASD). Prior research investigating sensory sensitivities and using event-related potentials (ERPs) has demonstrated atypical early visual processing in individuals with ASD. However, most ERP paradigms are repetitive and temporally predictable. Because early visual brain response is influenced by expectancy, the temporal regularity of previous ERP experiments represents a potential confound, raising the possibility that differences attributed to abnormalities in low level visual processing might reflect atypical response to predictable stimuli rather than disruptions in the functional integrity of the visual pathway.
Objectives: This study investigates the (a) relationship between sensory processing, as indexed by visual evoked potentials (VEPs), and the predictability of visual stimulation and (b) the degree to which this relationship is modulated by autistic traits and sensory characteristics.
Methods: ERPs were recorded from 10 typically developing adults (data collection is ongoing) using 128-channel sensor nets. Eye movements were recorded concurrently with an SR eye-tracking system. In two experimental paradigms, black and white checkerboards appeared on screen and reversed phase. In the predictable condition, the phase reversal occurred every 500ms. In the unpredictable condition, reversal occurred randomly between 300 and 1000ms. ERPs were time-locked to each phase reversal; occipital P1 and N1 amplitude and latency were extracted for analyses. Self-report questionnaires captured sensory features (Glasgow Sensory Questionnaire; GSQ) and autism characteristics (Broad Autism Phenotype Questionnaire; BAP-Q; Social Responsiveness Scale; SRS).
Results: Preliminary data analyses indicated that predictability of visual change had a statistically significant effect on P1 amplitude, $F(1,9)=6.323$, $p=.03$, such that P1 amplitudes were larger for the unpredictable condition. Larger N1 peak amplitudes in the unpredictable condition correlated with greater subthreshold autistic symptomatology (SRS Restricted Interest and Repetitive Behavior subscale, $r=.707$, $p<.05$). Difference scores for P1 amplitude between the unpredictable and predictable conditions correlated with the Visual Modality of the GSQ, $r=.764$, $p<.05$, such that increased amplitudes in the unpredictable condition explained higher levels of visual sensitivity. Additionally, difference scores for P1 latency demonstrate that earlier P1 responses in the unpredictable compared to the predictable condition were associated with an increased level of autistic traits (BAP-Q Pragmatic Language Subscale, $r=-.773$, $p=.009$).
Conclusions: Distinct neural responses were elicited by visual stimuli presented at predictable versus unpredictable rates. Moreover, variability associated with expectancy explained variance in the autism phenotype. Individuals who displayed enhanced or more rapid response to unpredictable stimuli reported increased visual sensory sensitivities, higher level of social-communication difficulties, and more repetitive interests and behaviors. Ongoing analyses will explore oscillatory harmonics of the VEP and the relationship between pupil dilation, brain activity, and symptomatology. These data show that symptom variability is associated with both early visual processing and top down expectancies and that these relationships are dissociable. By exploring the intersection of top-down and bottom-up sensory driven brain activity we are better poised to determine how these factors influence sensory and social symptomology and uncover sources of heterogeneity in ASD.

43 **160.043** Sex Differences in Amygdala Resting State Connectivity in Young Children with Autism Spectrum Disorder

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Background: Sex differences in neuropathology and neural phenotypes of autism spectrum disorder (ASD) are currently poorly understood. While prior research in pre-school aged males with ASD implicated atypical amygdala resting-state functional magnetic imaging (rfMRI) connectivity, these differences in functional connectivity have yet to be examined in a female cohort of young children.
Objectives: The current research examines sex-differences in resting state amygdala functional connectivity in preschool aged children with ASD.
Methods: The sample included 105 children with ASD (76 male, 29 female) and 51 age-matched typically developing (TD) controls (30 male, 21 female) (mean age 3.76 years). Diagnostic assessments for ASD were carried out by expert clinicians using the ADOS and ADI-R. Structural and resting state EPI BOLD images were acquired during natural nocturnal sleep. Resting state images were preprocessed using tools from AFNI, FSL, and ANTS in the Configurable Pipeline for the Analysis of Connectomes (C-PAC) using identical preprocessing parameters as reported in Shen et al., (2016). In brief, EPI images were time-shifted, motion corrected, and band-pass filtered ($.008 < f < .08$ Hz). Volumes with frame-wise displacement greater than 0.25mm were scrubbed. EPIs were then co-registered to the participant's structural T1-weighted image and then to MNI space, and smoothed at 6 mm FWHM. Seed-based connectivity analyses compared sex, diagnosis, and sex by diagnosis group differences in functional connectivity between amygdala and the rest of the brain. Cluster based correction for multiple comparisons was carried out using Gaussian Random Field theory using FSL ($Z > 2.3$, $p_{GRF} < .05$).
Results: Preliminary results revealed atypical amygdala functional connectivity in both boys and girls with ASD. Investigation of sex by diagnosis interactions revealed multiple clusters in frontal, temporal and cingulate cortices. In general, sex differences that were observed in typically developing males and females were attenuated in children with ASD. These results suggest that the neural phenotype of ASD in young children is differentially presented in males and females compared to their respective typically developing peers.
Conclusions: These preliminary data suggest that females and males with ASD have at least partially dissimilar patterns of functional connectivity with the amygdala.

44 **160.044** Sex Differences in the Neural Processing of Interactive Eye Contact in Individuals with Autism Spectrum Disorder

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Background: Sex differences in autism spectrum disorder (ASD) exist in the manifestation of social deficits (Lai, Lombardo, Auyeung, Chakrabarti, & Baron-Cohen, 2015), including differences in neural processing of static faces (Coffman, Anderson, Naples, & McPartland, 2015). However, sex differences in the neural correlates of social processing during dynamic social perception have not yet been examined, which may better reflect the interactive demands of social activity.
Objectives: To identify sex differences in neural processing of interactive eye contact in individuals with ASD and typical development.
Methods: Individuals with ASD (*n*=55; male=41) and typically developing (TD) individuals (*n*=44; male=26) participated in a gaze-contingent EEG experiment. Sex by diagnosis subgroups were matched for age and IQ. EEG data were collected using a 128 electrode Geodesic net, and eye-tracking data were collected using an SR-Research EyeLink 1000. Each trial began with a face displaying direct or averted gaze. When the participant looked at the face, the face responded by either looking at (direct gaze) or away from (averted gaze) the participant. P100 and N170 ERPs, components reflecting lower-level visual processing and face processing, respectively, were examined.
Results: A significant interaction was found between sex, diagnosis, and hemisphere for N170 peak amplitude ($F(1, 93)=9.10$, $p<.01$). Specifically, left hemisphere N170s were more negative than right hemisphere N170s for females with ASD, while males with ASD and TD females and males displayed the opposite lateralization pattern. There was also a significant interaction between sex, diagnosis, and condition (direct or averted gaze) for N170 peak amplitude ($F(1, 93)=5.26$, $p=0.02$). More negative N170s were evoked to direct gaze compared to averted gaze for females with ASD and males in both groups, while TD females displayed the reverse pattern. Eye-tracking results revealed a significant interaction between sex, diagnosis, and condition for amount of time looking at the eyes ($F(1, 93)=5.71$, $p=0.02$). Females with ASD spent a significantly longer time looking at the eyes in the averted compared to the direct condition ($t(15)=2.61$, $p=0.02$). There was no significant difference in looking patterns between conditions for other sex by diagnosis subgroups.
Conclusions: These findings suggest that there are important differences in how females with ASD respond to dynamic social interactions in both behavior and neural processing. Females with ASD look longer at eyes displaying averted compared to direct gaze, and, during these interactive tasks, this group displays atypical left-lateralization in neural response that differs from males with ASD and TD peers. Sex-specific brain activity and looking patterns in individuals with ASD highlight the importance of considering sex as a variable in understanding ASD and suggest distinct mechanisms underlying social perception in females with ASD.

45 **160.045** Striatal and Thalamic Metabolite Levels and Restricted and Repetitive Behaviors in Twins with Autism Spectrum Disorder

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Background:
Cortico-striatal-thalamo-cortical (CSTC) circuits are involved with carrying out goal-directed behaviors and disruption of these pathways is associated with aberrant behaviors, such as atypical repetition. Although limited, investigations of individuals with ASD support a relationship between CSTC circuit abnormalities and restricted and repetitive behaviors (RRB). For example, volumetric abnormalities in the striatum and thalamus in individuals with ASD are significantly associated with the severity of RRB symptoms.
Objectives:
The goal of this investigation was to examine neurochemical profiles of CSTC regions to determine whether children with ASD exhibit abnormalities that are related to RRB symptom severity.
Methods:
Data were acquired as part of a neuroimaging study of same-sex twin pairs that included monozygotic (MZ) and dizygotic (DZ) twins with ASD and typically-developing (TD) control twins. Clinical diagnosis of ASD was confirmed with the Autism Diagnostic Interview-Revised (ADI-R) and Autism Diagnostic Observation Schedule (ADOS). Cognitive and behavioral assessment included measures of intelligence, the Stanford Binet Intelligence Scales-Fifth Edition (SB-5), and autism-related symptom severity, the Social Responsiveness Scale (SRS) and Repetitive Behaviors Scale-Revised (RBS-R). Magnetic resonance imaging was carried out on a 3T GE scanner and an axial MR spectroscopy chemical shift imaging slab was acquired. The corresponding grid was shifted during post-processing to center voxels on the left and right thalamic nuclei and striatum. Metabolites were assessed in relation to internal creatine levels and adjusted for tissue composition. A subset of participants (only a single twin from each pair) with valid spectra from the thalamus and striatum (CRLB < 20%) were included.
Results:
For this preliminary analysis, thalamic voxels were available from 47 individuals with ASD (21 MZ and 26 DZ) and 33 TD (19 MZ and 14 DZ) and striatal voxels were available from 15 individuals with ASD (6 MZ and 9 DZ) and 20 TD (11 MZ and 9 DZ). The ASD and TD samples included children and adolescents (age range: 6-15 years) and were adequately matched as there were no group differences in age or gender, $p>0.05$. However, individuals with ASD exhibited lower IQ compared to controls ($M_{ASD}=74.49$,$SD=26.76$; $M_{CTRL}=112.00$,$SD=11.86$), $p<0.001$. Examining metabolite levels, N-acetyl aspartate (NAA) was significantly lower in ASD in the left thalamus ($M_{ASD}=1.39$,$SD=0.17$; $M_{CTRL}=1.47$,$SD=0.12$; $F(1,77)=7.89$, $p=0.021$) and left striatum ($M_{ASD}=1.32$,$SD=0.21$; $M_{CTRL}=1.47$,$SD=0.26$; $F(1,32)=7.36$, $p=0.011$). Furthermore, NAA levels in the thalamus ($r_{RBS-R}=-0.34$,$p=0.004$) and striatum ($r_{RBS-R}=-0.43$,$p=0.021$) were significantly associated with RRB symptoms, such as the compulsive behavior subscale of the RBS-R.
Conclusions:
Preliminary data from this investigation indicate that children and adolescents with ASD may be more likely to exhibit lower NAA levels in regions comprising CSTC circuits. NAA is a marker of neuronal integrity and is decreased in numerous neurological conditions; thus decreased NAA is considered a marker of underlying neuropathology. Our findings suggest that perturbation of CSTC circuits is associated with the presentation of RRB. Larger samples, more regions, and additional analyses, such as the assessment of heritability, will be examined as additional data is processed and will allow further elucidation of the neurobiological basis of restricted and repetitive behaviors in individuals with ASD.

46 **160.046** The Neural Mechanisms of Gaze-Based Social Interaction in Adults with High-Functioning Autism: Investigating the Effects of Predictability

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Background: Autism is characterized by impairments in communication and social interaction. Recent findings indicate that this might be due to disturbances in the automatic integration of social cues for decision-making. In addition, it has been proposed that low levels of predictability of the outcome of an interaction might be particularly problematic for individuals with autism.
Objectives: Hence, the main focus of this study is to examine whether the predictability of the outcome of an interaction has an influence on the neural basis of social encounters in adults with autism.
Methods: In a combined fMRI and eyetracking study individuals with high-functioning autism (HFA) and matched healthy controls were, therefore, asked to interact with a virtual character via gaze, who they believed was controlled by a real person outside the scanner. In contrast to this cover story, the agent's gaze behavior was systematically varied on a trial-by-trial basis to either follow or not follow the participant's gaze. Additionally, trials were either initiated with a cue predicting the outcome of the interaction or not. Accordingly, we analyzed how differences in the prior knowledge about the person's behavior would influence the neural activation patterns during gaze-based social interaction in individuals with HFA compared to the control participants.
Results: Results replicate previous findings that demonstrate the involvement of reward-related neurocircuitry during gaze-following in control subjects. By contrast, in HFA participants, differential effects were observed in primary sensory areas, while effects in reward-related regions were more strongly modulated by the predictability of the outcome of the interaction.
Conclusions: In sum, this study offers valuable insights into the neural mechanisms of gaze-based social interactions in individuals with HFA by demonstrating modulatory effects of predictability on the neural processing of social interactions.

47 **160.047** The Relationship Between Neural Correlates of Face Processing and Social Communication in Individuals with ASD and Schizophrenia

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Background: Difficulty interpreting facial expressions is a common feature of both autism spectrum disorder (ASD) and schizophrenia (SCZ), a disorder with many genetic, neurobiological, and phenotypic similarities to ASD. Consistent with the NIMH's Research Domain Criteria (RDoC) initiative, we sought to understand the neural correlates of face processing across these disorders. This study applied interactive neuroscience methods to study electrophysiological (EEG) brain response during a gaze-contingent paradigm that simulated face-to-face interactions. We aimed to explore the relationship between clinician-rated social communication and neural components of face processing across diagnostic categories.
Objectives: To examine the relationship between face-processing event related brain potential (ERP) components and social communication in ASD and SCZ.
Methods: ERPs were recorded from 14 adults with ASD and 12 adults with SCZ using a 128 electrode Geodesic Net; data collection is ongoing. Participants were presented with 80 distinct photorealistic, animated faces matched for low-level visual features. Utilizing gaze-contingent eye tracking technology, stimuli responded to a participant's direct fixation to the face by exhibiting happy or fearful emotions. P1 and N250 amplitudes were extracted from selected electrodes. All participants were administered the Autism Diagnostic Observation Schedule, 2ndÂ Edition (ADOS-2), a gold-standard diagnostic measure of ASD. ANCOVAs were conducted to investigate the relationship between ADOS severity or item scores and amplitude of the P1 and N250 components.
Results: There were no significant main effects or interactions involving diagnostic group (ASD, SCZ); thus, the following results collapse across diagnostic group. Preliminary analyses revealed a significant interaction between hemisphere, emotion, and ADOS Social Affect (SA) severity score, the covariate, on the mean amplitude of the N250 component (p=.037). Post-hoc correlational analyses showed that as SA severity increases, the N250 component in the right hemisphere is significantly attenuated when viewing happy faces (r= -.479, p=.013). There were no significant correlations between the N250 mean amplitude and SA severity in the left hemisphere or for fearful faces. An additional ANCOVA revealed a significant interaction between hemisphere, emotion, and the ADOS Unusual Eye Contact item score (p=.026) on the peak amplitude of the P1 component. Within-group follow-up t-tests revealed a trend toward more right lateralized P1 when viewing fearful faces for those with normative eye contact (p=.071); in contrast, those with more atypical eye contact showed increased right lateralization when viewing happy faces (p=.012). Between group follow-up t-tests did not reveal significant differences between the P1 peak amplitude of those with atypical eye contact and those with typical eye contact (p>.10).
Conclusions: Our results indicate that clinician ratings of social function are associated with neural response to emotional faces. Distinct patterns of responsivity were observed for different facial expressions, and eye contact during in vivo social interactions was associated with lateralization of brain responses to emotional expressions. These findings reveal relationships between social communication and neural sensitivity to facial expressions that span diagnostic categories, suggesting the importance of examining social communicative biomarkers in transdiagnostic samples.

48 **160.048** Visual Evoked Potentials As a Candidate Endophentype for Autism Spectrum Disorder

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Background: Sensory symptoms are common in individuals with autism spectrum disorder (ASD), particularly within the visual domain. Visual evoked potentials (VEPs) are an objective, reliable measure of early-stage visual processing that can be used to understand neural mechanisms in the brain while probing for disease pathology. The identification of endophenotypes, quantifiable, hereditary measures of risk that can help to identify links between phenotypic and genotypic variables, is critical for understanding disease susceptibility and protective factors. Previous literature has identified endophenotypes of schizophrenia using VEP paradigms. The current study seeks to examine endophenotypes of ASD using similar VEP methodology.
Objectives: To assess the integrity of visual pathways in unaffected siblings (SIBS) of children with idiopathic ASD (iASD) compared to typically developing (TD) children and children with iASD.
Methods: This study included children with iASD, SIBS, and TD controls between the ages of 2 and 12. ASD diagnoses were based on DSM-5 criteria, the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2), and the Autism Diagnostic Interview-Revised (ADI-R). Genetic testing (chromosomal microarray) was conducted on the ASD sample to rule out the presence of a genetic finding. Children in the SIBS and TD groups were screened with the Social Responsiveness Scale, Second Edition (SRS-2). VEPs were collected using single-channel EEG recording based on the International 10-20 system with an active electrode at Oz (occipital). A battery of both transient and steady-state VEPs was collected, which included a contrast-reversing checkerboard condition to elicit transient VEPs and two isolated-check conditions using bright or dark patterns of increasing contrast to elicit steady-state VEPs.
Results: Participants in the SIBS group displayed intermediate responses compared to the iASD and TD group for both transient and steady-state conditions. Results also replicated previous findings indicating significantly weaker VEP responses in children with iASD compared to TD controls. Specifically, significantly smaller amplitudes were found in response to the transient VEP condition and significantly smaller signal-to-noise ratios were found at low levels of contrast in the steady-state conditions, which reflects ON and OFF pathways in the brain.
Conclusions: Our results suggest that VEPs may reflect an endophenotype of ASD and are consistent with literature from neuroimaging and higher order electrophysiological studies demonstrating intermediate responses in unaffected siblings. The stimuli used in this study reflect mechanisms associated with excitatory/inhibitory imbalance (transient responses) and abnormalities in the magnocellular pathway (steady-state responses). Future studies should continue to examine these mechanisms and their potential as treatment targets. In addition, studies examining high-risk infant siblings are an important step to elucidate the relationship between VEP abnormalities and the presence of iASD.

Poster Session
161 - Cognition: Attention, Learning, Memory
5:00 PM - 6:30 PM - Golden Gate Ballroom

49 **161.049** A Gaze Contingent Exploration of Social Attention in Autism Spectrum Disorder

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Background:
Attending to faces is extremely important for understanding social cues and it is thought that atypical social attention may contribute to social difficulties in Autism Spectrum Disorder (ASD). However, research findings are mixed as to whether faces have the same special status in attention for people with ASD as in typical development. Methodological differences across studies make it hard to reach a consensus about social attention in ASD and why it may appear typical or atypical in different studies. Additionally, the Social Motivation Theory of autism predicts that individuals with ASD will attend to non-social objects of particular interest to them, rather than faces, and previous research has found that objects of Circumscribed Interest (CI) may disrupt social attention when co-occurring with people in a scene.
Objectives:
The present study employed visual scenes containing people and objects of CI to which adults with ASD have previously been found to attend atypically. A novel gaze contingent window technique explored the allocation of attention across these scenes among adults with and without ASD. This technique provides a measure of top down allocation of attention by removing opportunities for automatic attentional capture in peripheral vision.
Methods:
In Experiment 1, a gaze contingent window revealed part of a scene containing people and CI objects within 4˚ visual angle around the point of fixation, and moved with the participants' eye movements. In Experiment 2, participants saw an array of gift boxes, which, upon fixation, revealed a different image of either a face, an object of CI, or a neutral object. Frequency and duration of fixations within each area were recorded. Participants also later rated how much they liked each image and how interesting they found it to explore explicit interest in the stimuli.
Results:
Preliminary results (ASD: n=20 out of 30; Control: n=4 out of 30) found that all participants in Experiment 1 fixated for longer on faces within scenes compared to body or CI regions (ps < .04). In Experiment 2, participants with ASD had longer fixations to neutral objects compared to faces (p=.05). The frequency of fixations on each category of objects did not differ. In addition, participants with ASD rated faces as significantly less interesting and likeable than neutral or CI objects.
Conclusions:
Experiment 1 showed that when peripheral visual information is removed from a scene, social attention appears typical in adults with ASD, with faces holding attention longer than other objects once fixated. However, Experiment 2 found evidence for a reduction of social attention in participants with ASD, when objects were viewed without any meaningful context. This could be because social cues are more contextually relevant when trying to form an overview of a natural scene that is occluded (Experiment 1), compared to when there is no relation between hidden images (Experiment 2). This suggests that adults with ASD are able to preferentially allocate information to social cues when distracting information is removed, and it is beneficial to do so. Further time course analyses will help to elucidate these results.

50 **161.050** An Information Theory Approach to Assessing Perceptual Expectations in Autism

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Background: The capacity to implicitly process statistical regularities in one's environment is a core aspect of perception and cognition. Prior experiences of environmental regularities are used in conjunction with incoming sensory information to arrive at the perceived interpretation of the external environment.
There have been suggestions that there may be impairments in the ability to build these 'priors' in autism. Despite this, studies looking at implicit learning have failed to find significant differences between people with autism and the typical population. However, it is important to note that these studies predominantly focus on implicit learning under deterministic and stable conditions.
Objectives: We set out to assess i) whether differences in implicit learning occur in individuals with autism when underlying regularities are probabilistic rather than deterministic and ii) whether individuals with autism show differences in their ability to update these priors when the underlying regularities change.
Methods: We used a probabilistic serial reaction time task in which participants were asked to use key presses to respond to a visual target which appeared on the screen in one of four possible locations.
During the task, trial outcomes were determined by a probabilistic Markov chain. This was designed so that for each 2-back context, there was a probable and improbable target location for the subsequent trial. Acquiring implicit knowledge of the underlying structure of the trial sequence leads to reduced response times during probable trials when compared to improbable trials.
The participants (15 with a diagnosis of autism and 20 controls) were asked to complete a primary phase of 8 blocks (of 120 trials each) before moving on to a secondary phase of 8 blocks in which probable and improbable locations were reversed for all contexts.
Results: Individual differences in implicit acquisition of the underlying sequence in the task were assessed by comparing response times for probable and improbable trial types. To assess differences in the ability to adapt to changes in the underlying predictive structure, we calculated gain scores for performance in the second session relative to the first session.
We conducted a Bayesian Independent T-Test on the gain scores between the autism group (ASC) and the control group (CTR). The CTR group had higher gain scores on average than the ASC group (M = 0.67 and -1.21 respectively), with a Bayes factor of 19.90 in favor of the alternative hypothesis suggesting that there is strong evidence in support of a group difference.
We then used a computational model to assess how perceptual expectations are influenced by using different lengths of temporal window when calculating the level of uncertainty (Entropy) in the task environment.
Conclusions: Under stable probabilistic conditions, the ASC group showed increased rates of implicit learning relative to the CTR group. However, when the underlying probabilistic structure changed the ASC group were slower to update these expectations.
We discuss how data from computational models can be used to infer how attending to statistical regularities across different time scales might lead to the observed group differences in the behavioral data.

51 **161.051** Association Between Executive Functioning and Attention Deficit/Hyperactivity Disorder Symptoms in Younger Siblings of Children with Autism Spectrum Disorder.

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Background:
Relatives of individuals with autism spectrum disorder (ASD) often present with a variety of social and neurocognitive difficulties, despite not meeting formal criteria for ASD. This profile is termed "broader autism phenotype" (BAP) and often includes subclinical ASD symptoms. Difficulties in executive functioning (EF) characterize ASD and are associated with BAP. However, EF deficits are not unique to ASD, as it is also central to other disorders, including Attention Deficit/Hyperactivity Disorder (ADHD). ADHD and broader attentional problems are also present in relatives of individuals with ASD; therefore, whether EF difficulties in this population are more associated with ASD- or ADHD-like clinical profiles remains unclear.
Objectives:
To evaluate whether EF vulnerabilities are associated with symptoms of either BAP (sub-threshold ASD) or attention problems in a sample of younger siblings of children with ASD.
Methods:
22 younger siblings of children with ASDÂ (Mean age: 65.55 months; SD: 5.98, Range: 60-80 months) were administered a battery of EF tests from the NEPSY-II (Inhibition-Naming, Inhibition-Inhibition, Design Fluency, Auditory Attention, Statue) and evaluated for ASD and ADHD using the Social Responsiveness Scale (SRS), Autism Diagnostic Observation Schedule (ADOS), Child Behavior Checklist (CBCL) Attention Problems subscale, and clinician best estimate (CBE) of ASD and ADHD. Bivariate correlations were conducted to assess the association between EF and clinical symptomatology.
Results:
The EF Composite was not correlated significantly to indices of ASD-related symptomatology on the ADOS (r=-.074, p=.74), SRS (r=-.233, p=.32), or ASD CBE (r=.187, p=.42). Moreover, no EF subtest correlated significantly with any measure of ASD-related symptomatology (all ps>0.17). In contrast, EF abilities at five years-old were correlated significantly with the CBE of ADHD (r=-.663, p=.001) and correlations between the EF composite and parent reported symptoms on the CBCL Attention Problems subscale score approached statistical significance (r=-.398, p=.067). The Auditory Attention subtest scaled score correlated significantly with the CBCL Attention Problems score (r=-.515, p=.014), as well as marginally with the ADHD CBE score (r=-.350, p=.12). ADHD CBE correlated significantly with Inhibition-Naming (r=-.581, p=.006), Inhibition–Inhibition (r=-.550, p=.01), Statue (r=-.480, p=.028), and Design Fluency (r=-.468, p=.032).
Conclusions:
In younger siblings of children with ASD who do not meet criteria for ASD, EF difficulties are more associated with broad attention problems and ADHD than with subthreshold ASD features typically associated with BAP. Despite the high recurrence rate of ASD in siblings, these findings suggest that, when considering EF difficulties in relatives of individuals with ASD, clinicians should consider other clinical profiles, such as ADHD. In addition, further exploring the overlap and boundaries between ASD and ADHD may be an important area for future studies when considering EF in both clinical and non-clinical populations.

52 **161.052** Attention Engagement in ASD

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Background:
Deficits in attention related to disengaging from a stimulus and shifting to another is said to be impaired in autism spectrum disorders (ASD). This has been referred to as “sticky attention”, and tends to occur more in specific experimental paradigms versus being a central deficit in ASD (e.g., see McMorris & Bebko, this conference). Sticky attention has typically been measured by the latencies in participants’ responses to a new peripheral stimulus once presented. However, disengaging and shifting times may also be impacted by the degree to which participants are engaged in the *previous* stimulus *prior* to presentation of the new stimulus. That is, previously identified delays in disengaging or shifting may be secondary to events that preceded the onset of the new stimulus versus what occurs once the new stimulus is presented.Â In this study we look at variability of engagement that children and youth with ASD demonstrate with what has been termed the “central” stimulus in previous studies. Attention difficulties are often present in children with ASD (Keehn et al., 2010) and these differences are hypothesized to manifest in different degrees of engagement with stimuli, measured by time spent looking at a single stimulus prior to onset of a new stimulus.
Objectives:
Using an eye-tracking attention task, we examined the degree of attention engagement of children with ASD compared to typically developing (TD) peers as measured by duration of fixations to stimuli.
Methods:
Twenty TD children and 20 children with ASD matched on chronological age (range: 75-184 months) and cognitive abilities, watched a series of videos where stimuli would appear for 3 seconds sequentially in 4 quadrants of a TV screen. To examine potential differences in engagement by stimulus type, 2 types of stimuli were presented, social (a person telling a story) and non-social (e.g, hand playing a piano). Eye fixations were recorded using a Tobii eye-tracker.
Eye fixations were analyzed in two ways: 1) the sum total of all durations on each stimulus (SUMTOT); and 2) the duration of the last fixation before a new stimulus appeared (DLF). If sticky attention is related to the degree of *engagement* of attention *before* a new stimulus is shown, then longer durations should be seen in both methods for ASD.
Results:
Analysis of the DLF data yielded a main effect of group with TD being significantly more engaged than ASD, $F(1, 38) = 16.00$, $p < .001$. Similarly, SUMTOT was greater for TD, $F(1,36) = 9.78$, $p < .01$. Further analyses looking at the effect of stimulus type within groups are ongoing.
Conclusions:
These results suggest that differences in disengagement and shifting times in ASD found in previous research need to be re-evaluated in light of significant differences in degree of engagement with the central stimulus *prior* to the presentation of a second stimulus. Differences in engagement with one stimulus may facilitate/interfere with recognition of a changing display when a new peripheral stimulus is presented, altering the latency of response.

53 **161.053** Autistic Traits and Social Anxiety As Unique Predictors of Neural Attentional Responses during Facial Emotion Identification

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Background:
Individuals with autism spectrum disorder (ASD) exhibit impairments in the ability to perceive and respond to social cues, including facial emotion identification (e.g., Gross, 2004; Keehn et al., 2013). One reason for this deficit may be impairments in neural processing that occurs during emotion identification. Recent research using event-related potential (ERP) components of EEG has demonstrated both that autistic individuals show different neural processing when attending to emotional faces than that of non-ASD individuals (e.g., Sokhadze et al., 2015) and that neural processing is associated with differences in social skills (Hileman et al., 2011). Additionally, social anxiety is often co-morbid with ASD and, in individuals with ASD, social anxiety contributes to impaired facial emotion recognition (Corden et al., 2008). Research is needed to examine how traits related to autism and to social anxiety uniquely contribute to facial emotion identification.
Objectives:
The current study tested whether neural attention to faces depicting different emotions would be differentially affected by traits related to autism and social anxiety.
Methods:
Participants were 41 non-ASD undergraduate students (48.8% men; M_{age} = 19.7 years). Participants completed two self-report measures, the Autism Quotient (AQ, Baron-Cohen et al., 2001), and the Social Phobia and Anxiety Inventory (SPAI-23 Roberson-Nay et al., 2007), which assess autistic behaviors and social anxiety, respectively. While EEG was recorded from 65 electrodes, participants completed an oddball task in which deviant faces representing a change in emotion (i.e., happiness, anger, surprise, and fear) were presented within a series of faces displaying neutral emotions.
Results:
As is typical with an oddball task, visual inspection revealed a P3 ERP component which was quantified at electrode Pz between 300ms and 650ms. Separate analyses were conducted for each of the four oddball emotions: happiness, anger, surprise, and fear. Regression analyses were chosen to examine the unique contribution of autistic traits and social anxiety. These analyses revealed that, for happy stimuli, the AQ was a significant predictor of P3 amplitude, $B = -.95$, $t = -2.35$, $p = .043$, such that participants with more autistic traits showed lower amplitude P3s to happy faces. In addition, for fear faces, both AQ, $B = -.94$, $t = -3.04$, $p = .019$, and social anxiety, $B = 1.07$, $t = 2.48$, $p = .042$, significantly predicted P3 amplitudes. Interestingly, whereas higher autistic traits corresponded with smaller P3 amplitudes to the fear faces (see Figure 1), higher social anxiety was related to larger P3 amplitudes to the fear faces (see Figure 2).
Conclusions:
This study revealed that neural attention to faces depicting different emotions was uniquely predicted by traits related to autism and social anxiety. In fact, although measures of autistic traits and social anxiety are highly related, they were associated with different patterns of brain responses to fearful faces. This work sheds some light on differences in neural activation that impact the ability to perceive and respond to social cues. Future research should continue to examine how traits related to autism and to social anxiety uniquely contribute to facial emotion identification.

54 **161.054** Behavioral Flexibility and the Effect of Various Feedback Types: A Developmental Study

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Background:
In an ever-changing environment it is essential to shift strategies or adapt response patterns based on obtained feedback. Such behavioral flexibility is linked to executive functioning and cognitive control, but it has also been shown to have implications for social interactions. Accordingly it has also been linked to two core deficits of autism spectrum disorder (ASD): (1) deficits in social interactions and communication and (2) restricted, repetitive behaviors. Recent studies have used probabilistic reversal learning tasks to examine behavioral flexibility in adolescents and adults. By means of computational modeling (e.g., Hierarchical Bayesian learning models), the underlying processes could be examined more systematically and in depth[1,2]. However, developmental data is still scarce.
Objectives:
In our present study we aim to investigate behavioral flexibility in children and adolescents with and without ASD and systemically examine the effect of various feedback types (i.e. social, individualized and control feedback).
Methods:
The study is still ongoing. Until now 19 typically developing (TD) children (8 and 12 years of age), 14 TD adolescents (13 – 18 years of age) and 12 individuals with ASD (8 and 18 years of age) completed three runs of a probabilistic reversal learning task with either social, individualized or control feedback.
Results:
First, TD children needed more trials to reach the learning criteria (i.e., three consecutive correct trials) compared to TD adolescents. Second, TD adolescents profited more from control feedback than TD children. Third, TD adolescents made more preservative errors (i.e., an incorrect trial after reversal whereby participants have still chosen the previously reinforced response before they at least once chose the new/correct target) than TD children, whereas TD children made more regressive errors (i.e. an incorrect trial after reversal whereby participants choose the previously reinforced response after having already chosen the new/correct target at least once) than TD adolescents. Both type of errors are also highly negatively correlated. This might indicate that children are more susceptible to “false feedback” (which inevitably occurs due to the probabilistic task), and consequently may adapt their response choices more immediately and thus be less systematic than adolescents. The learning behavior of individuals with ASD was comparable to age- and gender-matched TD individuals, but children with ASD rated social feedback as less rewarding than their TD peers. In a next step, we aim to implement computational modeling of the behavioral data to pinpoint individual learning strategies. Additionally, the model parameters will be compared to various background variables (e.g., IQ, autistic traits, attention spam). This again would allow for a more systematic comparison of changes in behavioral flexibility during the course of development as well as its effects in ASD.
Conclusions: Â N/A

55 **161.055** Behavioral Response Inhibition Deficits in Individuals with Autism Spectrum Disorder and Their Parents

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Background: Individuals with autism spectrum disorder (ASD) show deficits in behavioral response inhibition, or the ability to suppress contextually inappropriate behaviors. We previously reported that response inhibition also is impaired in unaffected parents and siblings of children with ASD, suggesting that this deficit may be familial and serve as a useful intermediate phenotype for determining pathophysiological processes.
Objectives: To examine if deficits in response inhibition are evident in both individuals with ASD and their biological mothers and fathers.
Methods: Four participant groups completed a manual motor Stop Signal task (SST). Fifty-three probands with ASD ages 5-23 years were matched with 25 typically developing controls (ConPro) on age (5-23 years), gender, and nonverbal IQ. One hundred parents of the ASD (ASD parents) sample ages 29-54 years were matched with 43 typically developing adults (ConPts) on age (28-51 years), gender, and nonverbal IQ. For the SST, participants were seated with their thumbs resting on a button-box. Two types of trials were presented. During “GO” trials, a peripheral “GO” target appeared and participants were instructed to press the button corresponding to the side of the screen where the target appeared. During “STOP” trials, a central cue appeared at a variable delay after the “GO” cue indicating that they should inhibit their response. Prior to the SST, participants completed a block of GO trials to determine their baseline reaction times. We also examined participants’ reaction times for SST GO trials and their rate of successfully inhibiting responses on STOP trials.
Results: Individuals with ASD showed increased rates of stopping errors compared to ConPro ($t(76)=-2.225$, $p=0.029$). Participants increased their reaction times from baseline to SST GO trials, ($t(206)=34.400$, $p<0.001$). Individuals with ASD showed a smaller increase in reaction time from baseline to SST GO trials compared to controls ($t(62)=-2.108$, $p=0.039$). Greater increases in reaction time from baseline to SST GO trials were associated with increased rates of inhibition on STOP trials for probands ($r(39)=.459$, $p=0.003$) and ConPro individuals ($r(21)=.753$, $p<0.001$). This relationship was marginally stronger in ConPro than ASD individuals ($z=1.75$, $p=0.080$). ASD parents also showed increased rates of stopping errors compared to ConPts ($t(141)=-2.333$, $p=.021$). ASD parents showed lower reaction times at baseline ($t(141)=-2.766$, $p=0.006$) and during SST GO trials compared to ConPts ($t(141)=-2.786$, $p=0.006$). However, these groups did not differ on the degree to which they slowed their reaction times from baseline to SST GO trials ($p>.05$). Reduced rates of inhibiting STOP trials were associated with smaller increases in reaction time from baseline to SST GO trials for the ASD parents ($r(98)=.488$, $p<0.001$) and the ConPts ($r(41)=.305$, $p=.047$).
Conclusions: Our findings show that individuals with ASD have a reduced ability to inhibit inappropriate behaviors, and that these deficits reflect a failure to strategically delay the onset of these behaviors. Similar patterns of increased rates of stopping errors and reduced behavioral reaction times were seen in unaffected parents of individuals with ASD, suggesting that deficits in inhibitory control processes may be familial in ASD and useful for identifying pathogenic mechanisms.

56 **161.056** Characterizing the Heterogeneity of Academic Achievement in ASD

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Background: Â While autism spectrum disorders (ASD) are known for heterogeneous symptom presentation (Hu, 2009) and cognitive ability (Lenroot, 2013), the heterogeneity of ASD in academically-relevant domains, like math and reading, is still poorly understood. Although previous studies (Jones, 2009; Wei, 2015) have provided initial evidence on individual differences in academic achievement in ASD, no studies to date have used unbiased, data-driven, and quantitatively-validated approaches, nor included a typically-developing (TD) comparison group.
Objectives: Â The current study aims to: (a) characterize heterogeneous patterns of academic performance, namely math and reading skills, in children with ASD, using an unbiased and data-driven approach; (b) determine whether heterogeneous patterns are unique to children with ASD compared to TD peers; and (c) identify cognitive factors contributing to these heterogeneous patterns in ASD.
Methods: Â 118 children with ASD (ages: 7 – 13 years old; *M*=9.68; *sd*=1.51) and 96 age- and IQ-matched TDs (ages: 7-13 years old; *M*=9.39; *sd*=1.09) completed two standardized math (Wechsler Individual Achievement Test-II Numerical Operations and Mathematical Reasoning) and reading (WIAT-II Word Reading and Reading Comprehension) assessments. We used hierarchical clustering with complete-linkage criterion based on Euclidean distance (*NbClust* package in *R*) to separately cluster the ASD and TD samples by achievement measures. Logistic regression analysis was conducted to investigate cognitive predictors (IQ, verbal, visuo-spatial and executive working memory) of cluster-membership in both groups.
Results: The *NbClust* package recommended a two-cluster solution, characterized by one cluster with low and the other with high achievement, in each group (see Figure 1). In the ASD sample, we found a larger difference in math measures (71.54 points), between the Low and High clusters, than that in reading measures (23.35 points, $F(1, 116)=104.58$, $p<.001$). Moreover, the difference in math achievement between Low and High clusters was more pronounced in children with ASD than TD children (71.54â€…vs.Â 45.84 points, $F(1, 210)=24.41$, $p< .001$).
Logistic regression analysis revealed that a) IQ was predictive of cluster-membership in both groups (both $p < .01$); but (b) distinct components of working memory predicted cluster-membership in ASD vs. TD: in the ASD group, cluster-membership was predicted by verbal ($Z = 2.36$, $p = .018$) and executive ($Z = 2.44$, $p = .015$) working memory; whereas visuo-spatial working memory was predictive in the TD group ($Z = 3.46$, $p< .001$).
Conclusions: Â Our study addressed three key questions related to heterogeneity of academic skills in a large group of 7-13 year-old children with ASD. We found that (a) there was a heterogeneous pattern of weakness in math in the low achievement group and relative strength in math in the high achievement group (b) the math weakness in the low achievement group is unique to ASD relative to their TD peers; and (c) cognitive factors such as working memory differentially contribute to heterogeneous patterns of skills in ASD relative to TD children. These findings advance our understanding of heterogeneity in academic achievement in ASD, which may ultimately help us develop appropriate interventions to target and remediate low academic performance in this population.

57 **161.057** Comparing fNIRS-Based Cortical Activation Patterns Between Children with and without Autism, during Transitive and Intransitive Gestures

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Background: Children with Autism Spectrum Disorder (ASD) have significant impairments during gestural performance including errors during tool use, pantomime, and meaningless actions. Children with ASD had more errors during meaningless gestures compared to tool use or pantomime tasks; perhaps due to lack of a clear context (Smith & Bryson, 2007). Atypical perception-action couplings during early development in the children with ASD may impair one of the following processes represented within the Mirror Neuron Systems (MNS) and the sensori-motor systems: a) gesture perception involving temporal cortices, b) storage or transcoding of learned gestural sequences in the inferior parietal or frontal cortices and/or d) execution of motor programs by the primary motor cortices (Dowell et al., 2009).
Objectives: In the current study, we compared MNS and sensori-motor activation during three gestural tasks - object use, pantomime, meaningless.
Methods: 12 children with and without ASD between 6 and 12 years of age and 12 healthy adults were seated at a table with a hammer and pegboard. The task involved holding a hammer and hitting eight pegs on a pegboard in 3 ways: a) *Holds hammer*: the child hit the pegs with an actual hammer, b) *Pantomimes*: *the* child pretends to do the same hammering action, and c) *Meaningless*: the child performs air tapping. 24 trials were collected, 8 per condition using a randomized block design. The oxy hemoglobin response of the fNIRS signal was further analyzed to study differences in activation patterns between tasks, between hemispheres, and between the regions of interest (temporal, inferior frontal and parietal).
Results: Our preliminary data suggest greater cortical activation during the meaningless condition compared to pantomime or tool use conditions within the inferior parietal and inferior frontal cortices. We did not notice clear patterns in terms of hemispheric or regional differences.
Conclusions: Differences in MNS and sensori-motor cortex activation across gestural tasks will help explain the differing cortical contributions. In terms of intervention implications, our findings may support the notion of providing a clear context to aid successful completion of transitive gestures in children with ASD.

58 **161.058** Comparison of Parent- and Teacher-Report of Executive Function Deficits on Adaptive Behavior Skills in Individuals with and without ASD

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Background: The importance of the real-world everyday skills defined by adaptive behavior for successful social functioning and independent living of individuals with ASD has been documented in the literature. There is often a significant gap between IQ and adaptive behavior for individuals with ASD without co-occurring intellectual disability (HFASD). Deficits in executive function (EF) skills have been associated with impaired adaptive functioning. However, most studies have assessed EF skills via parent report on measures such as the Behavior Rating Scale of Executive Function (BRIEF) and have not also included a second source of information such as teacher observations of EF skills in the classroom. Inclusion of another informant could enhance the understanding of previous findings.
Objectives: The study aim is twofold: 1) Examine the role of teacher-reported EF deficits on adaptive behavior functioning in comparison to parent report among a group of individuals with HFASD and 2) Determine if the relationship between EF deficits and adaptive behavior is transdiagnostic by including a clinical comparison group of individuals referred for an ASD evaluation but not meeting diagnostic criteria.
Methods: This is an IRB-approved record review study of diagnostic evaluations of a clinically-referred population ages 6-18 years seen at an outpatient clinic. ASD diagnoses were based on ADOS-2 scores and experienced clinical judgment; SRS-2 was used as a measure of ASD symptom severity. Adaptive functioning was measured by parent report on the ABAS-2 and ABAS-3 Practical domain. The BRIEF and BRIEF-2 were used to measure EF skills.
Results: Data collection and analyses are ongoing with a total anticipated n=60-65. Currently, ASD group n=28 and non-ASD group n=19. The groups are evenly matched for age (ASD *M*=9.82; non-ASD *M*=9.63, $t(45)=-.25$, $p>.05$) and nonverbal IQ (ASD *M*=99.11; non-ASD *M*=94.21, $t(45)= -1.09$, $p>.05$). Both groups had significantly impaired functioning on the Practical domain (ASD *M*=67.54; non-ASD *M*=70.47). Parent and teacher report of overall EF deficits were not correlated in either group (ASD $r=.25$, $p=.17$; non-ASD $r=.28$, $p=.17$). Teacher report of EF subscales were not correlated with the Practical domain for the ASD group (r's<.16, p's>.27), yet Initiate and Organization of Materials was negatively correlated with Practical domain in the non-ASD group (r's>.47, p's<0.4). Per parent report, significant correlations between the Practical domain and Initiate, Working Memory, and Plan/Organize existed for the ASD group (r's>.32, p's<.04), while in the non-ASD group Practical skills were correlated with Shift ($r=-.42$, $p=.04$).
Conclusions: Â While EF and Practical skills deficits were noted across clinical groups, parents tended to report more difficulties. Different relations between EF and Practical skills were found between the ASD and non-ASD groups. A better understanding of the factors that contribute to a more successful outcome for high functioning individuals with ASD is necessary to develop effective interventions. Nearly half of individuals with ASD have average or above cognitive abilities yet do poorly with the practical everyday adaptive behavior skills. Interventions that improve EF skills may be particularly helpful in increasing functional independence for this fastest growing subgroup of individuals with ASD.

59 **161.059** Cultural Influence on Natural Scene Viewing in Autism: A Comparison Between Japan and the UK

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Background: It is well established that the broader social context in which we live, such as cultural background, plays a critical role in shaping perceptual and cognitive development. For example, previous cross-cultural research has found that East Asian and Western adults have different viewing styles while looking at non-social naturalistic pictures – Western adults tend to look longer at the focal objects whilst East Asian adults focus more on background information (Chua, Boland & Nisbett, 2005). There is very little research, however, on the extent and nature of these cultural differences in children, and especially in children on the autism spectrum.
Objectives: We therefore investigated (1) whether cultural differences in non-social perception can also be observed in typically developing children, and (2) whether autistic children also show similar perceptual patterns as their same-culture counterparts.
Methods: Four groups of children took part in the study; Typical Japanese (n=31), Typical British (n=27), Autistic Japanese (n=31) and Autistic British (n=26), all aged between 6 and 18 years, and matched in terms of intellectual ability and gender. All Japanese children were tested in Tokyo; all children in the UK were tested in London. We used static images from Chua et al., each of which contained one focal object (e.g., animal or vehicle) in naturalistic backgrounds (e.g., mountains). We excluded stimuli containing human images from our study to focus on non-social perception. Children were asked to look freely at a series of 14 images on the screen. Each picture was presented for 3 seconds.
Results: Participants' eye movements were recorded using a Tobii TX300 eye tracker and the proportions of time spent looking at the focal and background areas of interest (AOIs) were calculated for analyses. We found an interaction between cultural backgrounds and AOIs, $F(1,111)=8.95$, $p=.003$. Japanese children looked significantly longer on the background AOI than on the focal AOI, $t(113)=-3.06$, $p=.003$, opposite to British children who looked longer on the focal AOI, $t(113)=3.06$, $p=.003$. Critically, however, there was no significant effect of diagnostic status (autistic, typical) and no interactions involving diagnostic status, all $ps \leq .43$
Conclusions: This is the first studies to examine cultural differences in non-social perception in school-age typical and autistic children with eye-tracking technique. We found strong cultural influences on non-social perception between Japanese and British participants, and these influences were similar across autistic and typical children. These results suggest that children on the autism spectrum are as much influenced by their broader social environments, such as cultural background, as their typically developing counterparts when engaging in a non-social free-viewing task. Future research should examine the role of cultural background in the development of perception *and* cognition in autistic individuals in order to draw a fuller picture of the condition.

60 **161.060** Differences in Sleep Related Learning in Children with ASD and Williams Syndrome

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Background: Several factors have been outlined as having a negative impact on cognitive and behavioral functioning of individuals with Autism Spectrum Disorders (ASD) and Williams Syndrome (WS). Sleep is the main focus of the current study since a number of studies reported that children with ASD and WS experience severe sleep problems. Since sleep has been found to play an active role in children's memory consolidation, it is vital to assess the impact of sleep on children's functioning.
Objectives: The current study aimed to examine if there were any specific sleep related learning patterns in two developmental disorders, namely ASD and WS. Children in both disorders have been reported to have specific sleep problems: children with ASD often suffer from frequent night wakings, whereas children with WS suffer from sleep onset delay. In both groups, comparison of the sleep-dependent memory consolidation has not been examined.
Methods: Participants included school aged children: 12 typically developing (TD)and 12 children with ASD and 12 children with WS.
Sleep dependent memory consolidation was assessed using an Animal Names task, a child-friendly and engaging declarative memory task. Sleep was further assessed using the Childhood Sleep Habits Questionnaire and actigraphy to objectively measure sleep quality and quanitity.
Results: As expected, TD children had higher scores on the Animal Names task following intervals of sleep, rather than wake, indicating that during periods of night-time sleep children's memory traces of the animal's names were strengthened. Similary children with ASD showed similar pattern to the TD group albeit showing poorer performance scores. Children with WS showed a different pattern to both groups. Significant differences in Sleep Duration, Night Wakings were found between the groups. There were large group differences in all sleep variables, showing specific sleep problems in the clinical groups as well as learning patterns when correlated to sleep.
Conclusions: The current study suggests that sleep plays an active role in cognitive functioning in children. The study emphasizes the importance of sleep in children with developmental disorders and its role in the process of learning. It is concluded, that sleep has a strengthening effect on the memories of both TD and children with ASD but not WS.
Gaining a better understanding of the influence of sleep on learning in children is an important factor in order to implement better teaching interventions.

61 **161.061** Differing Perspectives: Examining Reports of Executive Function in Children with ASD & ADHD

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Background: Measuring Executive Function (EF) skills is imperative in assessing overall behavior and outcomes in children as they progress through school. EF deficits are prominent among children who have an Autism Spectrum Disorder (ASD) or Attention Deficit Hyperactivity Disorder (ADHD).
Objectives: This study aims to evaluate how parents, teachers and observers report EF behavior among the two diagnostic groups.
Methods: A sample of mainstream school children either with an ASD (N=46) or ADHD (N=103) (ages *M*=10.03; *SD*=.89) participated in a school-based EF intervention study. Student behavior was observed by treatment-blinded research staff twice within the school year, and teachers reported on behavior using a modified version of the SKAMP (Swanson, 1992). Parents completed the Behavior Rating Inventory of Executive Function (BRIEF) (Gioia et al., 2000). SKAMPS and classroom observations yield scores on several EF skills, including transitioning, attending to work, and following rules, while the BRIEF assesses EF in the school and home environments. Greater impairment of EF skills are indicated by lower scores on the classrooms observations and higher scores on the SKAMPS.
Results: Within the entire sample, parent scores on the BRIEF Global Executive Composite index (GEC) were correlated with teacher's reports of EF skills on the SKAMP (*r*=.222, *p*<.002). Total SKAMP and classroom observation scores were significantly correlated for both groups (*r*=-.340, *p*<.00). When divided by diagnosis, differences were found between the two groups, specifically in regards to parent report. Children with ASD had similar overall levels of EF skills, as reported on the SKAMP and classroom observations (*r*= -.486, *p* <.000). However, BRIEF GEC scores were not correlated with SKAMP scores. When parents reported difficulties within the Monitor scale on the BRIEF, correlations were found for SKAMP items, including: the total SKAMP score, sticking with tasks, and getting started on assignments. Within the ADHD sample, teacher and parent ratings were significantly correlated (*r*=.216, *p*<.010). Observation total scores and BRIEF GEC scores were not correlated (*r*=.005, *p*<.943).
Conclusions: Among teachers, parents, and blinded observers, agreement was significant within the entire sample for behaviors related to EF. However, differences were found within the two diagnostic groups, suggesting that multi-informant approaches are important when measuring outcomes. Varying the lenses for reporting EF skills in children is important in capturing different behaviors, as well as across diagnoses.

62 **161.062** Dimensional Autistic Traits Predict Susceptibility to False Memory: Sex Differences in Source Monitoring and Gist Construction

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Background: Â Fuzzy trace theory (FTT) has been used to account for autistic individuals' often exceptional verbatim memory, and to suggest that the same autistic cognitive style may confer resistance to false memory.
Objectives: Â To assess the relationship between dimensional variations in autistic traits and false memory.
Methods: Â The Deese-Roediger-McDermott (DRM) word-list false-memory paradigm was used in combination with Autism Spectrum Quotient (AQ) subscales and two performance-based measures of autistic traits – the 'Reading the Mind in the Eyes' Test (RMET) and the Embedded Figures Test (EFT) – to assay effects of individual and sex differences in empathising and systemising traits on authentic and false memory in 89 (45 female) typically developing young adults.
Results: Â A Sex x AQ(Social) interaction predicted correct recalls, $F(1, 74) = 5.19$, $p = .026$, and the output positions thereof, $F(1, 74) = 4.13$, $p = .046$: in females high AQ(Social) predicted fewer ($r = -.288$) and earlier ($r = -.173$) correct recalls. Likewise, in females high RMET predicted more correct recalls, $F(1, 75) = 5.23$, $p = .025$, $r = 0.281$. No such effects were present in males. Sex x AQ(Social) x AQ(Detail) influenced number of critical lure false recalls, $F(1, 74) = 5.92$ $p = .017$: among males with high social skills (low AQ(Social)), attention to detail (high AQ(Detail)) increased the number of false recalls, but in males with low social skills, attention to detail decreased the number of falsely recalled critical lures. Females exhibited the opposite pattern, high social skills yielding a negative and low social skills a positive relationship between attention to detail and number of falsely recalled critical lures. Again in females, faster disembedding on the EFT (Sex x EFT $F(1, 75) = 6.98$, $p = .01$, $r = 0.429$) and lower RMET score (Sex x RMET $F(1, 75) = 8.97$, $p = .004$, $r = 0.308$) both were associated with fewer critical lure false recalls.
Conclusions: The restriction of semantic gist (reduction in critical lure recalls) associated with increased AQ(Detail) in those females with low AQ(Social) suggests that in females the main determinant of false recall is systemising. Whereas heightened RMET in males only reduced false memory, implying a source-monitoring effect, females' RMET increased both correct *and* false memory, associating heightened empathising skill with heightened gist construction. These relationships suggest that semantic and theory-of-mind aspects of females' empathising abilities are more closely related than males': Empathising deficits may impair semantic association in females, but source monitoring in males. Implications include the identification of traits predicting individual differences in false-memory susceptibility (a rarity in false-memory research), greater understanding of cognitive mechanisms underlying the uniquely autistic style of memory, and appreciation of the potential clinical importance of false-memory susceptibility in persons with autism spectrum conditions: This interpretation predicts that in males with Broader Autism Phenotype or in general high levels of autistic traits, confusion of endogenous beliefs with exogenous observations – particularly where impaired social perception creates a vacuum of true observations – might in part underlie deficits in the formation and maintenance of social relationships.

63 **161.063** Distinguishing Between Implicit and Explicit Measures of Metacognition in ASD

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Background:
Metacognitive monitoring (awareness of one's own mental states/cognition) is a key component of self-awareness and plays an important role in learning. The few existing studies of metacognitive monitoring in ASD have employed tests that require participants to make explicit judgements about the state of their own knowledge. The closer the correspondence between *judgements* of one's knowledge and *actual* (objectively-measured) knowledge, the more accurate metacognitive monitoring is. Findings using such explicit tasks have been mixed. In the current investigation, we aimed to resolve a discrepancy in findings across previous studies by employing not only a standard test of explicit metacognitive monitoring, but also a paradigm adapted from one used in comparative psychology to assess metacognitive monitoring non-verbally/implicitly.
Objectives:
The aim of the present study was to investigate implicit *and* explicit metacognition in ASD.Â
Methods:
Data collection is ~80% complete. 22 participants with ASD and 18 age- and IQ-matched comparison participants completed a "gambling" paradigm based on that used among monkeys by Son & Kornell (2005). This involved a visual discrimination task (e.g., judging most pixelated of two squares). After a decision had been made on each trial, participants were required to choose from one of two shapes (circle/triangle). Correct visual discrimination resulted in a payment gain, while incorrect visual discrimination resulted in financial loss, with subsequent shape selection dictating whether gain/loss was of high (triangle) or low (circle) value. Accurate metacognitive monitoring was indicated by a greater tendency to choose the high-value "Triangle" on successful visual discrimination trials than on unsuccessful trials, and to choose the low-value "Circle" more on unsuccessful than successful trials. In a second session, participants completed the same gambling task (but different visual discrimination task). This time, after each visual discrimination trial, participants were explicitly asked "Are you confident?", with "Yes" (high-value gain/loss) or "No" (low-value gain/loss) chosen in response. Selecting "Yes" on successful visual discrimination trials more than on unsuccessful trials and, vice versa, by choosing "No" more on unsuccessful than successful trials indicated accurate metacognitive monitoring.
Results:
In both tasks, Gamma correlations were utilised to measure metacognitive performance. Across both tasks, between-group differences were apparent. Gamma correlations were lower among participants with ASD than comparison participants in both the implicit (ASD M = .32, SD = .59; Comparison M = .58, SD = .26; t = 1.78, p = .08, d = .58) and explicit tasks (ASD M = .56, SD = .39; Comparison M = .71, SD = .21; t = 1.49, p = .15, d = .49). Correlations between metacognitive monitoring performance and background cognitive measures of theory of mind and of ASD feature severity/traits will be analysed and discussed.
Conclusions:
These results complement the existing literature and provide evidence of an explicit metacognitive deficit in ASD. However, they extend the field significantly by providing the first evidence of a deficit in a non-verbal/implicit form of metacognitive monitoring. This suggests a pervasive difficulty with this ability at all levels among people with ASD, which may contribute to learning difficulties in this disorder.

64 **161.064** Early Learning Processes in Autism and Williams Syndrome: Commonalities and Differences in Relation to Cognitive and Adaptive Functioning

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Background: Autism spectrum disorder (ASD) and Williams syndrome (WS) are neurodevelopmental disorders with an opposing profile of cognitive and behavioral features. While opposing propensities for social engagement appear to be the key distinction between ASD and WS, there are striking commonalities in social and communicative difficulties across these disorders. Both convergences and divergences have been observed across domain-general and domain-specific early learning processes that might shape differential outcomes across ASD and WS.
Objectives: In the present study, we examined how preschoolers with ASD, WS and typical development (TD) performed in tasks tapping both domain-general (working memory, sustained attention, habituation) and domain-specific (social and joint attention, motor intention, imitation, spontaneous object use) early learning processes. Here we aimed to (1) document early emerging commonalities and differences across key early learning processes in children with ASD and WS, and in comparison to TD children, and (2) examine concurrent associations with intellectual and adaptive functioning in ASD, WS and TD children.
Methods: We recruited young children (aged 27 to 92 months) with ASD (n = 54, mean DQ = 66), and with WS (n = 24, mean DQ = 56) who were age-matched to a group of TD children (n = 20, mean DQ = 108). Measures of domain-general and domain-specific early learning processes were administered using a combination of eye tracking and behavioural observation. Multiple regression was used in preliminary analyses to assess the relative contribution of individual aspects of early learning to concurrent levels of intellectual and adaptive function.
Results: Preliminary results revealed that groups performed similarly in working memory, social attention, and motor intention, while in all other tasks group differences were evident. In the ASD group, sustained attention was the only significant factor associated with intellectual and adaptive function. In the WS group, spontaneous object use and joint attention were significantly associated with intellectual function, while imitation was associated with adaptive function. In TD children, sustained attention and joint attention were significantly associated with both intellectual and adaptive function, while habituation and spontaneous object use were associated with intellectual function.
Conclusions: Children with ASD and WS show different patterns of relationships between key early learning processes and intellectual and adaptive development. In young TD children both domain-general and domain-specific cognitive abilities emerged as significant factors in intellectual and adaptive functioning. This contrasted with ASD where only sustained attention was associated with intellectual and adaptive functioning, and WS where domain-specific cognitive abilities appeared to be more significant. These findings have the potential to inform our understanding of syndrome-specific early learning processes that might shape intellectual and adaptive outcomes, and inform the development of early interventions that focus on relative cognitive strengths to build on domains of weakness, an approach that may have cascading effects on later outcomes in ASD and WS.

65 **161.065** Emotional False Memories in Children with Autism Spectrum Disorder

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Background: Memory functioning in children with ASD is a relatively neglected area of research. However, there is evidence that adults with ASD, compared to adults with typical development (TD), may be less prone to experience associative illusions of memory as a result of impaired ability to engage in semantic processing (Beversdorf et al., 2000). However, it is unclear whether this pattern of results is present in children tested for memories of pictures of sequences of life events and memories that include emotional content. Work in other neurodevelopmental disorders has shown that children with non-verbal learning disorder (NLD) show a tendency to falsely recognize unseen causes of negative emotional events more than neutral events, suggesting that emotion facilitates this type of inferential error for children with NLD (Mirandola et al., 2014). In contrast, our work has shown that adolescents and young adults with ASD struggle to process positive emotion as demonstrated by their failure to process positive feedback (Solomon et al., 2011).
Objectives: To test if emotion facilitates the rate and type of false recognition of events in a sample of children with ASD and TD.
Methods: The present study examined children with ASD (N=27; Age M=10.8, SD=1.4) and an IQ-matched sample of children with TD (N=37; Age M=11.3, SD=1.5). Participants viewed a series of photographs for scripted events (e.g., making dinner, waking up in the morning). Embedded in each scripted episode were positive, negative, and neutral consequences (i.e., effects) of unseen actions (i.e., causes). Memory was then tested on a yes/no recognition task that included old and new photographs (i.e., distractors). Three classes of distractors were used: *Causal*: These photographs depicted unseen causes of seen effects (positive, negative and neutral); *Gap-Filling*: These photographs included unseen events that were consistent with viewed scripts (positive, negative and neutral); and *Inconsistent*: These photographs included unseen events that were inconsistent with viewed scripts.
Results: Both groups provided strong evidence of memory for photographs as indicated by high recognition hit rates for viewed photographs and low false alarm rates of unseen and script inconsistent pictures (See Table 1). Children with ASD falsely recognized more unseen photographs than did children with TD (t=4.259, p<.001), but the type of distractor mattered. Interestingly, children with ASD were equally likely to falsely recognize both unseen causes of seen photographs and photographs consistent with the script when they were positive (t= -0.592, p=.559), while both groups were more likely to falsely recognize unseen causes (i.e. causal errors) of negative and neutral events compared to gap-filling negative and neutral events. See Figure 1. Neither group showed an association between age and rate of error type.
Conclusions: These results support past research by showing that generally children have higher overall rates of causal errors than gap-filling errors though we found that children with ASD did not show this pattern for positive events. This atypical process of positive emotion is consistent with our group's prior findings of impairment in use of positive feedback and could have important implications for self-esteem, learning, and psychopathology.

66 **161.066** Endogenous Visual Orienting with and without Saccades in Autism Spectrum Disorder: An Eye-Tracking Study

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Background:
Endogenous visual orienting is the allocation of visual attention resources to a spatial location driven by symbolic cues or internal goals. Previous research suggests that people with ASD display differences in their use of symbolic cues in endogenous orienting compared with people who do not have ASD, and that temporal aspects of task performance may play a significant role in group differences (Landry et al., 2009; Landry & Parker, 2013).Â
Objectives:
The study examined the temporal properties of endogenous orienting in the context of traditional endogenous orienting with a button press response, and with eye-tracking.
Methods:
Participants with ASD (n = 16, Males = 13, mean age = 10.79 years, age range = 6 to 21 years) and typically developing participants (TD) (n= 16, Males = 12, mean age = 10.92 years, age range = 6 to 22 years) completed the tasks. Both groups were matched on raw scores for the Raven's Progressive Matrices, age and gender. Two experimental tasks were completed: a traditional Posner (1980) arrow cuing task with forced-choice button press responses, and an overt orienting task in which participants were instructed to saccade to the target. Both tasks included valid (75%) and invalid (25%) cues at different cue-target SOAs (150ms, 300ms, 450ms, 600ms, 750ms, 900ms). To maintain task engagement, the saccade task also included the instructions that participants should press a button if the target was an animal (and not press for an object). Eye-tracking was performed during both tasks. This was to ensure participants maintained central fixation during the traditional button press task, and to measure saccades during the saccadic overt orienting task.
Results:
A 2x2x6 Mixed ANOVA examined orienting effects (calculated as: (invalid-valid) / average RT across all trials). No differences were found between ASD and TD participants in the magnitude of orienting overall (ME Group p=.46), nor as a function of SOA (Group x SOA p=.33), nor did they differ in orienting as a function of whether the task was the traditional button press Posner task or a saccadic overt orienting task (Task x Group x SOA p=.24); Figure 1 shows the patterns of orienting for both groups. A 2x2x6 Mixed ANOVA was used to examine saccadic velocity during the saccadic overt orienting task. A significant Group by SOA interaction was found, F (3, 31) = 8.45, p<.001; Figure 2 shows the different SOA patterns shown by the two groups.
Conclusions:
In this sample, we did not replicate previous findings of differential orienting performance for ASD. We found very similar patterns of orienting across 6 SOAs in both a traditional button-press arrow-cued endogenous orienting task and when saccadic RT was measured in overt shifts following endogenous cues. We found different patterns of saccadic velocity across SOA between ASD and TD participants. This finding is intriguing, as orienting performance did not differ between groups on the saccadic task, despite different patterns of saccadic velocity across SOA between groups.

67 **161.067** Error Types in Synchrony Judgements of Audiovisual Stimuli in Children with Autism Spectrum Disorders

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Background:
Intermodal perception (IMP), the ability of integrating multiple sensory information (e.g., visual and auditory) into a single, coherent perception, is crucial to different aspects of development (e.g., Bahrick, 2010). Atypical IMP has been found in individuals with autism spectrum disorders (ASD) (e.g., Bebko et al., 2013; Iarocci & McDonald, 2006; Stevenson et al., 2014), and there has been a growing appreciation of potential links between the sensory experiences of those with ASD and social-communicative deficits. For example, Bebko et al., 2006 found a linguistic-specific deficit in children with ASD when discriminating the synchrony of audiovisual stimuli using a preferential looking paradigm.
Objectives:
The current study attempts to expand on the results of Bebko et al., 2006, by using a task requiring an explicit response about whether auditory and visual stimuli are synchronous (synchrony judgement). Patterns of correct responses and error types were analyzed to gain a better understanding of what is contributing to atypical IMP in ASD.
Methods:
Twenty children with ASD (M= 12.7 years, SD=2.96) and thirty non-clinical children (TD) (M=11.9 years, SD= 3.05) were asked to determine whether audio and visual components of a stimulus were synchronous or not. Five stimulus types were presented: social-linguistic (SL: someone reading a story), social-non-linguistic (SNL: a person making popping sounds), non-social-non-linguistic (NSNL: e.g., a hand playing the piano), and emotion (EH: someone laughing or crying).
Results:
The ASD group (*M*= 77.36%) had a significantly lower percentage of correct synchrony judgements versus the TD group (*M* = 85.66%), *F*(1,49)=6.575, *p*=.013. The proportions of errors made were examined by stimulus type in a 2-way mixed model ANOVA. A significant main effect was found for stimulus type, where both groups made more judgement errors for the emotion stimuli. A within-group post-hoc analysis showed that the TD group made more errors for the positive affect versus negative affect, *t*(1,29)=2.467, p=.019, while the ASD group made equal mistakes on both types of the EH stimuli.
Errors were also separated out by synchrony type: that is, responding as synchronous when the stimulus was asynchronous, and vice versa. A 2-way mixed model ANOVA with error types and group yielded a significant main effect of error type. Both groups were less likely to misidentify a synchronous stimulus as asynchronous. A within-group post-hoc analysis showed that the ASD participants were more likely to erroneously respond that an asynchronous visual-leading stimuli was synchronous than for audio-leading stimuli, *t*(1.19)=2.658.This difference was not observed in the TD group.
Conclusions:
The more explicit judgements required in this task were expected to help participants with ASD overcome their difficulties with audiovisual IMP in more subtle tasks. However, the ASD group made significantly more errors in a synchrony judgement task, even though the asynchronous stimuli were offset by 1 second, a very large offset.Â The present findings indicate that helping to focus the participants' attention to the task by requesting a concrete motor response was not sufficient to help overcome the underlying audiovisual IMP issues. Further research is needed to better understand these challenges.

68 **161.068** Examining the Mathematical Abilities of Children and Adolescents with Autism Spectrum Disorders: A Meta-Analysis

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Background: To date, there is a great deal of uncertainty about how Autism Spectrum Disorder (ASD) influences the mathematical skills of individuals in this population. Researchers have found that the rates of math giftedness and math disability in ASD are much higher than in the typically developing (TD) population with up 46% of a particular sample of individuals with ASD categorized by math disability and up to 34% categorized by math giftedness (Brown, 2013). The high levels of both math giftedness and disability found in the ASD population could suggest that some unique factor or set of factors associated with autism leads to either extreme math strengths or weaknesses.
In order to develop appropriate interventions, remediation and even enhancement activities, we need to be able to predict which individuals with ASD may have math strengths versus weaknesses. In order to make these predictions, we must investigate possible variables that have been previously shown to predict math success in other populations. Four variables that we propose to examine in relation to the math skills of the ASD population are: visual-spatial/motor ability (VSM), executive functioning (EF), general knowledge (Gk) and vocabulary knowledge (Vk).
Objectives: Â 1. To determine the size of the difference between individuals with ASD and their TD peers in two measures of math ability—arithmetic and math problem solving (Ps)—as well as the direction and the consistency of this effect. 2. To examine four predictors of math ability in the ASD population.
Methods: After a comprehensive database search, we collected data on 1056 children and adolescents with ASD across 35 studies. Using the metafor package in R (Viechtbauer, 2010), we derived the standardized mean differences (SMD; Hedge's g) between the math scores of individuals with ASD and their TD peers along with meta-regression models examining predictors of their math ability.
Results: The models demonstrated that individuals with ASD performed significantly lower (g = -0.5) than their TD peers in both arithmetic and Ps and the resultant prediction intervals were -2.26 to 1.30SD and -2.76 to 1.95SD, respectively. Secondly, the SMDs across the two math areas were highly variable and this variability was not only due to random error. The meta-regression model for arithmetic demonstrated that EF and VSM were significant predictors of math ability (ß = 0.028, ß = 0.031, respectively; p < .001), yet Gk and Vk were not.
Conclusions: Our findings reject the stereotype of mathematical prowess among individuals with autism, as their average performance was lower than their TD peers. As well, the range of the prediction intervals were wide, but positively skewed, indicating that students with ASD were more likely to struggle in math than to excel. Finally, the outcome of the meta-regression model was generally in line with the Pathways model of numerical development, according to which mathematical ability is influenced in distinct ways by different neural pathways (LeFevre et al., 2010). The current analyses suggest that VSM and EF may be critically important to understanding how the autistic mind processes mathematical information.

69 **161.069** Executive Function: Cognition and Behaviour in Adults with Autism

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Background: Executive function (EF) is a complex cognitive construct incorporating a number of processes associated with higher-level thought and behaviour across the life-span. EF has been much studied in Autism Spectrum conditions with inconsistent findings reported in terms of impairment across the different facets of EF. It is thus not clear if impairments in EF are truly characteristic of ASD in respect of cognition and if cognitive deficits are consistently related to behavioural features. Co-morbidity and individual heterogeneity are important factors to take account of in study design.
Objectives: The study aimed to investigate the performance of high functioning adults without intellectual disability with robust diagnosis of Autism Spectrum Disorder (ASD) across a range of EF tasks, and particularly to consider the issue of heterogenity. The study also explored whether EF impairments impact on (a) everyday function and (b) ASD symptomatology including repetitive behaviours.
Methods: Participants with ASD (n=110) were compared with age and IQ matched healthy controls (n=31) on a battery of well validated clinical neuropsychology tasks assessing planning, cognitive flexibility, inhibition, generativity/fluency and speed of task completion. Information about the behavioural characteristics associated with EF difficulties was collected using standardised informant and self-report. Participants with co-morbid ADHD, psychosis and neurological disability were excluded from the study. Group differences across the main test indices were investigated. Exploratory factor analysis was employed to consider the universality of impairment across EF function.
Results: Participants with ASD were significantly more likely to score in the impaired range across all the EF tasks, although notably approximately 1/3 of the ASD group were not impaired on any of the EF test indices. Significantly higher levels of behavioural, cognitive and emotional characteristics associated with EF were reported in the ASD group. Exploratory factor analysis confirmed a single underlying construct or 'EF factor' consistent with the theoretical account in the literature of a single over-arching executive process. This 'EF factor' was not related to ASD symptoms or behavioural characteristics. Behavioural characteristics associated with ASD could also not be accounted for by co-morbid psychiatric difficulties such as anxiety.
Conclusions: The majority of high functioning adults with ASD are impaired across a number of tests of executive function when compared to adults without ASD. Performance across EF tests was found to represent a single underlying construct. Everyday difficulties associated with EF impairment are common in adults with ASD but on the basis of these findings are not accounted for by performance on neuropsychological tests, ASD symptoms or psychiatric co-morbidity. The findings of this study suggest executive function is an important domain to consider when assessing adults with ASD in respect of formulating difficulties and modifying interventions to reduce executive demands. Further investigation into 'dysexecutive' difficulties in everyday function in ASD is warranted. Notably one third of adults with ASD in this study were not impired on any of the EF measures.

70 **161.070** Eye Avoidance in Young Children with Autism Spectrum Disorder When Scanning Emotional Faces

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Background: Abnormal face scanning patterns have been consistently found in individuals with autism spectrum disorders (ASD) (see Falck-Ytter & von Hofsten, 2011, for a review), which may be associated with their face processing deficits. Particularly, some studies have found that participants with ASD spent less time looking at the eye region when scanning faces compared to typically developing (TD) counterparts (e.g., Pelphrey et al., 2002; Yi et al., 2013). Tanaka and Sung (2013) proposed an “eye avoidance’’ hypothesis of autism in face processing, which suggested that individuals with ASD avoid the eye region because it is perceived as socially threatening. In line with this hypothesis, individuals with ASD may show stronger tendency to avoid looking at eyes of faces with threatening expressions (e.g., anger) than other expressions.
Objectives: The current study aimed to further examine the “eye avoidance” hypothesis by comparing the eye looking time of children with ASD to that of TD children when viewing faces with different expressions.
Methods: We showed faces with different emotional expressions (joy, anger, sadness, and neutral) to 2- to 5-year-old ASD (*n* = 28) and age-matched TD (*n*= 31) children for 5 seconds when their eye movements were recorded using a Tobii T60 eye tracker. Sad facial expressions were included to avoid a possible confound between threat-relatedness and negativity of the displayed emotion. We used temporal course measures to examine the proportional fixation time on the eyes in three continuous phases: the 5-second looking time (300 sample data in total) was divided equally into three phases (early, middle, and late phases, each of which was about 1667 ms) and we wanted to determine whether and when effects of different scanning patterns to the eyes appeared. This analysis allowed us to test whether the patterns observed in the current study are stable or more dynamic across viewing time and thus it may provide a more complete picture into face scanning.
Results: We found that: (1) children with ASD fixated less on the eyes than TD children only for angry and neutral faces, but the two group scanned similarly for happy and sad faces; (2) children with ASD scanned less on the eyes of angry faces than that of happy and sad faces, while TD children scanned more on the eyes of angry and sad faces than that of happy faces; (3) temporal course analysis revealed that: for neutral faces, children with ASD showed an attention avoidance toward eye region than TD children in the early, middle phases but not in the late phase; whereas for angry faces, children with ASD showed more avoidance to the eyes than TD children in all the three phases.
Conclusions: Our study demonstrates that facial expressions moderate eye avoidance pattern in children with ASD when scanning faces. These results suggest that young children with ASD do not have a general eye avoidance pattern in face scanning, rather, this pattern is limited to the threat-related expressions.

71 **161.071** Eye Tracking on an Unmodified Ipad for Visual Attention of Children with and without ASD: A Feasibility Test

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Background: Eye tracking is widely used in autism research to study visual social cognition. However, most studies depend on expensive commercial eye-tracking devices, which dramatically restricts accessibility. In this study, we used video-based eye tracking-algorithms to implement and validate eye tracking on an unmodified tablet, an advance which could increase the accessibility of eye tracking for researchers and families.
Objectives: 1) To implement eye tracking on an unmodified iPad, 2) To validate calibration and looking time by using smooth pursuit, 3) To compare looking behaviors of children with Autism Spectrum Disorder (ASD) with controls.
Methods: Participants were 21 children (4 to 8 years old: 6 typically developing (TD), 4 developmentally delayed (DD), and 11 children with autism spectrum disorder (ASD)) and 6 TD adults. Participants watched three 5-minutes videos on an iPad; each video video contained three 5-point calibrations and two animated smooth pursuit trajectories. Using front facing camera recordings, we applied image processing to track head and eye movement for use in eye tracking calculations. Calibration errors and proportion of valid looking on screen (Valid%) were calculated. Percentage of looking during smooth pursuit was calculated as a validation and measure of sustained attention. Repeated measures ANOVA was conducted to examine between group differences.
Results: Adults failed 5.6% of calibrations (failure defined as looking at fewer than 3 of 5 calibration target points), and had an average calibration error (1.1 deg) and Valid% (81.7% ±4.0%) significantly better than children ($p = .005$, $F = 4.364$; $p<.001$, $F = 21.6$). Similarly adults looked more during smooth pursuit trajectory validations compared to children (83.3% ±2.9%, $p<.001$, $F =12.3$).
The TD group failed 11.1% of calibrations, DD failed 30% and ASD 22.2%. However, in passed calibrations errors were comparable between the three groups: TD 1.5 deg, DD 1.3 deg and ASD 1.4 deg. Valid% was not different between the three groups of children (58.7% ± 4% in TD, 52.3% ± 4.7% in DD with $p = .303$, and 53.2% ± 3% in ASD with $p=.280$ between TD and ASD). Both TD (56.0% ± 3%, $p = .049$) and DD (59.8%±3.5%, $p = .007$) groups exhibited significantly higher proportions of following the smooth pursuit trajectory than the ASD children (48.6%±2.3%). There was no performance difference between DD and TD ($p=.397$).
Conclusions: The preliminary data found that children with ASD and DD looked at less at calibration points than their TD peers, and that the ASD group showed lower percentage of valid looking while following smooth pursuit trajectories than TD and DD groups. This study provides evidence for the application of iPad eye tracking as a viable option for tracking eye movements and studying visual attention in children with and without ASD, but also points towards tablet-based eye tracking as a method for understanding potentially broader issues in sustained attention in children with ASD.

72 **161.072** Frontal Midline Theta Activity Explains Differences in Reaction Time Variability Between ASD and ADHD

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Background: Reaction time (RT) measures have long been recognised as a valuable indicator of cognitive performance in ASD (e.g. Jensen, 1992). RT data as it currently stands lacks specificity to a single psychiatric population and so has not been seen as a particularly useful marker for ASD. Our previous findings have shown that RT data, in particular, variation in reaction times (RT variability/RTV), may show some specificity between autism spectrum disorders (ASD) and attention deficit hyperactivity disorder (ADHD) (Tye et al. 2016) but this is not always clear (Tye et al. 2013). Brain function studies point towards a relationship between RT measures and medial frontal (MF) brain activity (Bellgrove et al. 2004; McLoughlin et al. 2014). Our recent work showed a strong relationship between RT measures and an EEG source signal from the MF region of the brain in the 5-7 Hz frequency range (theta) (McLoughlin et al. 2014). However, there is little research into the neurophysiological underpinnings of this relationship, nor of the relationship between theta activity and ASD.
Objectives: To understand the underlying neurophysiology of RT data in ASD, and further to examine if theta-indexed neurophysiological measures can clarify differences and similarities between ASD and ADHD in RTs.
Methods: Children with ASD (n=19), ADHD (n=18) and typically developing controls (TDC; n=26) completed the CPT-OX task, with concurrent EEG recording, which was identical to that used in our previous studies (McLoughlin et al. 2010, 2011; Tye et al. 2014.). Instructions indicated to respond only to the target in cue-target sequences (XOX-OXO). The remainder were attentional stimuli (e.g. XOX-OXO) or distractors. Power and phase were calculated in the theta frequency band to compare inhibitory stimuli (e.g. XOX-ODO) to other stimuli (e.g. XOX-OXO) using independent components (IC) of the EEG data.
Results: We showed alterations in only ADHD children for RTV and mean RTs, However, we found abnormalities in both ASD and ADHD for theta power compared to TDC across all stimuli. We also found abnormalities in the phase onset of theta time-locked to inhibitory stimuli in ADHD compared to the ASD and TDC group. Greater theta phase variability was associated with increased RT variability across all groups.
Conclusions: Our results suggest that children with both ASHD and ASD have altered cognitive control, indexed by decreased theta power localised to a source in the MF cortex. However, we show that the integrity of MF systems may be more compromised in ADHD compared to both ASD and TDC indicated by increased RTV and theta phase variability. Our findings may suggest disparate cortical sources for RT abnormalities in ASD and ADHD. Cognitive theories differ in whether they propose shared underlying causes between the disorders or disparate etiological pathways. Our findings confirm the importance of cognitive control in both ASD and ADHD pathophysiology but also suggest that some abnormalities in ASD may be independent of demands on the cognitive control system in ADHD, consistent with a model of limited shared causal pathways to the disorders.

73 **161.073** Gaze Abnormality Can Distinguish Between Autism Spectrum Disorder and Typically Developing Children through Screening in 5-Year-Old Children By a Double Blind Study in a Japanese Community Based Population

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Background: A number of studies have identified unique visual gaze patterns in individuals with autism spectrum disorder (ASD) using eye-tracking systems. Such gaze fixation patterns in individuals with ASD are considered to be associated with social attention. However, the past studies show different results between ASD and typically developing (TD).
Objectives: Using Gazefinder, an all-in-one eye-tracking system for early detection of ASD in toddlers, we examined the gaze characteristics of toddlers to specific objects in individuals with and without ASD in a 5-year-old children by a double blind study in Japanese community based population.
Methods: We measured the percentage of eye fixation time allocated to particular objects depicted in movies by five-year-old children in a community health check-up (n=438) by double blind study. In the community health check-up spanning three years (2013-2015, N=3804), the participants screened in the community health check-up were 2923 children. The local government officers invited 440 children (included 31 applicants) to additional assessments and an interview based on the results of the screening. Subjects of analysis are ASD (n=84) who diagnosed by DSM-5 criteria and TD (n=98) who had no abnormalities in all the experiment. We compared these percentages between the two groups. Gazefinder incorporates movies of human faces, biological motion, and people and geometric shapes, and it provides almost instantaneous data by automatically calculating the percentage fixation time allocated by the participants among regions of interest in the movie. In addition to the total trial time is short (approximately 2 min), and instructions or verbal answers are not required; the participant simply views a video monitor.
Results: Compared with the TD group, the ASD group showed significantly less fixation time at locations of salient social information (the available percentage fixation time, 'eyes' region in the movie of human faces without lip movement, 'mouth' region with talking and 'people' region in the movie of people and geometry), while there were no significant group wise differences in the responses to biological motion. However, the percentage fixation times exhibited small effect sizes for the group difference. In ROC analysis in each area of interest, the significant AUCs wereÂ .600 ('eyes' region, silent), .590 ('mouth region',Â talking), .652 and .586 ('people' region, same size and small size).Â AUCs were low accuracy (<0.7).
Conclusions: This study showed gaze abnormalities can distinguish ASD and TD through screening, in order to improve the accuracy of screening, it is necessary to examine further these contents.

74 **161.074** Hot and Cool Executive Function and Theory of Mind in Children and Adolescents with Autism Spectrum Disorder: Cross Sectional Developmental Trajectories

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Background:
Research on the development of Executive Function (EF) has indicated that the emergence of EF occurs in the early years of life, followed by critical changes throughout the preschool era. There is significant evidence suggesting that it continues to develop at least during the adolescence, protracted to the development of the prefrontal cortex. Despite research supporting separate domains of cool and hot EF, traditionally, the development of EF in ASD has been investigated mainly using tasks tapping only the "cool"-purely cognitive- aspects of EF. Thus, minimal is known about the developmental trajectories of "hot"-affective EF processes and whether cool and hot EF follow a similar developmental pathway in ASD. Finally, although the development of cool EF and its links to Theory of Mind (ToM) have been widely examined, understanding of the development of hot EF and its relation to ToM in ASD is very limited.
Objectives:
The present study sought to examine the age-related changes in both cool and hot EF of ASD participants from middle childhood to adolescence, shedding more light on the hot-cool EF organisation. It also explored the interrelation between the developmental trajectories of cool & hot EF and ToM in ASD.
Methods:
The current study employed a cross-sectional developmental trajectories approach to compare the hot and cool EF profiles as well as ToM, relative to chronological age between children and adolescents with ASD and typically developing peers. 170 participants (91 controls and 79 with ASD) between 7 and 16 years old were assessed on measures tapping cool EF (*working memory*, *inhibition*, *planning*), hot EF (*affective decision making*, *delay discounting*) and ToM (*emotion understanding*, *false no false belief knowledge*).
Results:
Results demonstrated that the developmental trajectories of selective cool EF (working memory, planning) differed significantly as a function of age (age-related changes) in participants with ASD relative to typically developing participants. Cool EF inhibition followed the same developmental pattern as in the control group (improvements with age) while for the hot EF, both ASD and control groups presented no significant changes across younger and older participants. Gains were also reported in both ToM measures for both groups. Developmental trajectories of cool and hot EF skills were related to ToM developmental trajectory in ASD.
Conclusions:
Theoretical implications are discussed as the examination of the developmental trajectories of the EF cognitive processes and their effect on social cognition such as ToM could contribute to our better understanding of the phenotypes of children and adolescents with ASD. These findings highlight the need to assess both hot and cool EF developmental trajectories in clinical practice as they may aid in enhancing diagnosis or better informed intervention programs.

75 **161.075** Impulse Control to Specific Interests in Children with Autism Versus Typical Development

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Background: Deficits in impulse control and behavioral regulation are characteristic of autism spectrum disorder (ASD). Impulsivity negatively impacts learning and interferes with behavioral interventions in ASD. In typical development (TD), prior work has shown increased impulsivity to happy faces but in ASD, social cues have less significance. It is unknown how cues that are salient to children with ASD, such as special interests, influence impulsivity.
Objectives: The goal of this study was to examine impulse control to interests versus social cues in ASD and TD. We hypothesized that impulsivity in children with ASD would be greatest to special interests versus faces and the opposite pattern would be observed in TD.
Methods: 34 children participated: 15 children with ASD (13 male, mean age 9 (7-12 yrs), mean VIQ = 97; mean NVIQ = 94; mean ADOS CSS Total = 8.4) and 19 TD children (18 male, mean age 9 (5-12 yrs), mean VIQ= 115, mean NVIQ = 115). Children performed a novel go/nogo task on an iPad with 5 different conditions. For non-social conditions, children chose their favorite hobby (interest) and their least favorite hobby (non-interest). For social conditions, children were presented with happy or calm faces. A control condition presented colored shapes. Children were instructed to touch 'go' cues and to withhold responses to 'nogo' cues. All 5 conditions served as both go and nogo cues and were counterbalanced across participants. D-prime was calculated as the normalized hit rate (go-accuracy) minus normalized false alarm rate. Reaction time variability was assessed with ex-Gaussian distribution functions.
Results: Go-accuracy did not differ by group, demonstrating all children attended to the conditions. For d-prime using linear mixed effects models there was an interaction between condition and group (F(105.84) =4.993,Â p = 0.001) demonstrating in TD there was lower d-primes (greater impulsivity) to happy faces relative to interests (p=0.023) and lower d-prime to neutral faces relative to interests (p=0.008). As hypothesized, children with ASD demonstrated a trend of lower d-prime to their interests relative to TD (p=0.093), with no differences between groups to faces or non-interests, suggesting that children with ASD may be more biased and distracted by their interests relative to TD. There were no significant differences between conditions in the ASD group and no significant interactions between condition and diagnosis on the ex-Gaussian functions. These parameters will be explored further as data collection is ongoing.
Conclusions: Children who were typically developing were more impulsive to socials cues than their interests, suggesting that interests elicited greater attention and facilitated inhibition. In contrast, there was a trend that children with ASD were more biased by their interests relative to TD, suggesting that interests may be particularly distracting for children with ASD and decrease inhibition. Ultimately identifying cues that are salient to children with ASD and thus increase impulsivity and distraction will be important for improving interventions that target attention and behavioral regulation.

76 **161.076** Increased Access to Information, but Not Increased Feedback, Enhances Category Learning in Autism

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Background: Popular autism interventions often feature high levels of feedback as well as the breaking down of tasks or information into numerous small increments presented sequentially. However, these practices are not necessarily consistent with a small but growing literature on how autistics learn well (Foti et al., 2015), including by spontaneously extracting regularities from large arrays of information (Mottron et al., 2009, 2013). Autistics have shown a range of performance in category learning tasks (Gastgeb et al., 2012; Schipul et al., 2012; Soulières et al., 2010), suggesting that changes in how and how much information is presented may affect how well autistics learn.
Objectives: Assess how access to information (sequential vs. simultaneous presentation) and level of feedback (high vs. low intensity) during learning affects the probabilistic categorization performance of autistic and typical children.
Methods: 108 children were tested on one of two probabilistic categorization tasks (Shohamy et al., 2004; Brown et al. 2010). To date, data have been analysed for 11 autistic (age=9.0 years, *SD*=1.5; WISC-IV PRI=108.0, *SD*=16.09) and 16 typical (age=9.0 years, *SD*=1.4, *p*=1.0; PRI=115.4, *SD*=12.0, *p*=0.17) children tested on the *feedback* task; and for different groups of 16 autistic (age=10.3 years, *SD*=2.0; PRI=105.9, *SD*=15.8) and 18 typical (age=9.2 years, *SD*=1.2, *p*=0.08; PRI=115.0, *SD*=11.0, *p*=0.06) children tested on the *presentation* task. 14 artificial stimuli varying across 4 dimensions had to be classified into 2 categories based on 5 different probabilities. Each stimulus was probabilistically associated with an outcome. Tasks varied either in information *presentation* (sequentially, one stimulus at a time vs. simultaneously, all stimuli together) or *feedback* level (*low* vs. *high* intensity nonsocial informative feedback) in the 200-trial learning phase, which was followed by two 70-trial test phases. Test1 used learning-phase stimuli, while Test2 used equivalent but new stimuli requiring generalization of learning.
Results: Â Preliminary analyses were conducted of test-phase accuracy, reported here as mean number of correctly classified stimuli out of 70. Intensity of feedback (*low* vs. *high*) did not affect Test1 accuracy in either group (typical: *low*=42.2, *SD*=9.3, *high*=42.4, *SD*=7.2; autistic: *low*=40.0, *SD*=12.4, *high*=46.3, *SD*=9.3), *p's*>.05. The same was true for Test2 (typical: *low*=42.0, *SD*=12.6, *high*=44.5, *SD*=11.4; autistic: *low*=45.8, *SD*=10.3, *high*=46.3, *SD*=12.0), *p's*>.05. However, autistic children's Test1 accuracy was significantly better when information was presented simultaneously during learning (46.9, *SD* 5.6) versus sequentially (36.8, *SD* 8.3, *p*=.01), while this made no difference in typical children (43.9, *SD*=8.2 vs. 49.6, *SD*=7.07, *p*=.176). In Test2, autistics again benefited from simultaneously (51.7, *SD*=6.21) versus sequentially (42.4, *SD*=4.7, *p*=.01) presented information during learning, with no difference in typical children (40.5, *SD*=13.2 vs. 48.2, *SD*=12.6, *p*=.125). Further analyses are ongoing.
Conclusions: In a probabilistic category learning task, increased access to information enhanced autistic children's category learning and generalization, while increased feedback had no effect. Our preliminary results suggest the relative non-importance of feedback intensity to autistic learning, and that limiting autistic children to small increments of information, presented one at a time, may impede or undermine their learning. Increasing autistic children's access to information they can process well should be a priority.

77 **161.077** Inhibitory Control Deficits in ASD Reflect Failures to Strategically Delay Behavioral Responses

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Background: Deficits of behavioral response inhibition, including reduced abilities to suppress contextually inappropriate behaviors, have been repeatedly documented in ASD. We recently demonstrated that healthy individuals are more likely to inhibit unwanted behavioral responses when they strategically delay their onset. Determining the extent to which individuals with ASD use similar cognitive strategies to support response inhibition across childhood and into adulthood may provide important insights into cognitive processes underlying reduced inhibitory control in ASD.
Objectives: To characterize behavioral response inhibition and underlying neurocognitive strategies in children, adolescents, and adults with ASD using a stop-signal task (SST).
Methods: One hundred twenty-two individuals with ASD and 76 healthy controls matched on age (5-28 years), gender, and nonverbal IQ completed a manual motor SST. Participants were instructed to press a button when a peripheral target appeared ('GO' trials) or inhibit these responses when a central stop-signal appeared following the peripheral cue ('STOP' trials). A baseline reaction time (RT) task consisting of a block of GO trials was administered to assess adaptive RT slowing during SST GO trials. Non-linear regression models were used to assess the relationship between SST accuracy and slowing as function of age. The Repetitive Behavior Scale-Revised (RBS-R) was used to assess the relationship between SST performance and repetitive behaviors in patients.
Results: Â Individuals with ASD showed reduced rates of successfully inhibiting motor responses on STOP trials compared to controls. Participants slowed their RTs during SST GO trials compared to baseline, but individuals with ASD slowed their RTs less than controls. Greater RT slowing was associated with reduced inhibition error rates for participants, and this relationship was stronger for controls than patients. Participants demonstrated age-related increases in stopping accuracy and RT slowing that were best modeled as a cubic function. Individuals with ASD showed less age-related increases in SST accuracy and slowing. Reduced stopping accuracy and RT slowing were associated with more severe repetitive behaviors, including compulsive, self-injurious, and ritualistic behaviors.
Conclusions: Our results provide novel evidence that deficits inhibiting behavioral responses in ASD may reflect a reduced ability to strategically delay the onset of motor responses. Whereas healthy individuals slow their behavioral responses in uncertain conditions and thereby increase their ability to suppress inappropriate responses, individuals with ASD are less able to use this strategy and therefore have greater difficulty suppressing unwanted responses when they are cued to stop. Our findings that deficits of inhibitory control are related to repetitive behaviors suggest that patients' failures to suppress attention to or engagement in a particular behavior may contribute to their compulsive and ritualistic actions. Our findings also suggest that treatments aimed at slowing behavioral responses may mitigate impulsive behavioral responses and repetitive behaviors in ASD, and that these treatments may continue to be effective if implemented in later childhood or adolescence.

78 **161.078** Internal Noise and Global Motion Pooling and Their Relationship with Autistic Traits in Typically Developed Adults.

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Background:
People with autism spectrum disorder (ASD) display abnormalities in motion processing. Motion perception abnormalities in ASD have been linked to high levels of internal noise (unreliable neuronal fluctuations), and deficits in global motion pooling (integrating local motion into a global percept). There are two types of internal noise: additive ('baseline' that is constant across different amounts of external, i.e. stimulus, noise); and multiplicative (proportional to external noise). Previously, internal noise in ASD has been investigated through additive internal noise, comparing ASD and control groups. However, multiplicative noise has not yet been investigated in terms of ASD and neither type of internal noise has been investigated in terms of traits of autism in typically developed populations.
Objectives:
To investigate how additive and multiplicative internal noise and global motion pooling vary across number of autistic traits in typically developed adults.
Methods:
To achieve these aims, we employed a visual motion integration task with a typically developed population, measuring autistic traits with the Autism Spectrum Questionnaire (AQ). Forty-five adults (M_{age}= 22.18, SD_{age}= 4.96) indicated average direction (left or right) of 200 dots across eight external noise levels (varied with increased directional noise). Additive and multiplicative internal noise and global motion pooling were calculated from task accuracy and consistency across external noise levels, using equivalent noise analysis (ENA), within a double-pass paradigm. ENA compares human performance to an 'ideal observer' with known levels of additive internal noise and pooling (Lu & Dosher, 2008). An equivalent noise function is then fit to these data to estimate internal noise and pooling (Manning et al., 2014). This method of analysis has been used within populations of both ASD (Manning et al., 2015) and typically developed individuals (Burgess & Colborne, 1988).
Results:
A Mann-Whitney U test revealed no significant difference in additive noise between those with high (Mean Rank = 22.45, n = 20) and low (Mean Rank = 20.64, n = 22) AQ scores, U = 201.00, p= .56, two-tailed. No significant correlation was found between multiplicative noise and AQ score: r= -0.03, p= .84, or between global motion pooling and AQ score: r= 0.12, p= .448. Bayesian statistics indicate these values give moderate support for the null hypothesis, with BF_{10}=0.12, and 0.16, for multiplicative noise and global motion pooling, respectively.
Conclusions:
Our results suggest that differences in internal noise and global motion pooling may not be present across a sub-clinical spectrum of autistic traits. In support of Manning et al. (2015), who found no difference in internal noise between ASD and control groups using similar methods, our results may be tentatively extrapolated to clinical ASD populations. We offer support for the *absence* of a difference in internal noise and global motion pooling between clinical ASD and typically developed populations.

79 **161.079** Intuitive and Reflective Reasoning in Autism Spectrum Disorder

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Background:
Dual Process Theory has been a major theory within psychology for over 50 years. It proposes that there are two distinct types of reasoning process: Type 1 which is autonomous and typically rapid and nonconscious ('intuition'), and Type 2 which is typically slower and conscious ('reflective') and dependent upon working memory capabilities. Recently a Dual Process Theory of Autism has been proposed to suggest that reasoning in Autism can be characterised as Type 2 processing dominating over Type 1 processing (Brosnan et al., 2016). This can be assessed through the Cognitive Reflection test (CRT) which is a series of three apparently simple questions that have a correct reflective response but also an incorrect response that is argued to be an intuitive response. The task is not purely ipsative as it is also possible to make random errors. The typical dominance of the intuitive response in this task is reflected in only 17% of over three thousand American college students getting all the questions correct.
Objectives:
Investigate the relationship between autistic traits and autism diagnosis upon intuitive and reflective responses on the CRT – controlling for an index of non-verbal IQ.
Methods:
Participants were 26 people with a diagnosis of autism (17M, 9F) and 22 Typically Developing (TD) controls (11M, 11F), with the proportion of males and females not significantly different between the groups (Chi=1.16, p>.05). Participants were 16-24 years old (mean = 18.31, sd=1.40), and age did not significantly differ between the groups. Participants completed the AQ, the CRT and 12 items (subscale I) of Ravens Matrices as an index of non-verbal IQ (NVIQ).
Results:
The means (standard deviations) for both groups are reported in Table 1. A MANOVA was conducted with CRT-Intuitive and CRT-Reflective responses as the dependent variables and Group (ASD/TD) as the independent variable with sex (Male/Female) and NVIQ as covariates. The ASD group made significantly less intuitive responses ($F(1,44)=4.43$, $p<.05$), with no significant difference in reflective responses ($F(1,44)=2.38$, $p>.05$). The covariates were not significant. Finally a partial correlation controlling for group (ASD/TD) and sex (Male/female) revealed a significant negative correlation between autistic-like traits and CRT-Intuitive ($r(44)= -.29$, $p<.05$) and a significant positive correlation between autistic-like traits and CRT-Deliberative ($r(44)= +.25$, $p<.05$).

Table 1	ASD	TD	
AQ (max 50)	29.42 (5.48)	14.73 (4.91)	t(46)=9.71, p<.001
NVIQ (max 12)	9.58 (1.72)	9.91 (1.44)	ns
CRT_Intuitive (max 3)	0.54 (0.71)	1.14 (1.04)	t(46)=2.36, p<.05
CRT_Reflective (max 3)	1.38 (0.85)	1.82 (1.10)	ns

Conclusions:
Consistent with the Dual Process Theory of Autism, higher autistic-like traits and a diagnosis of ASD related to fewer intuitive responses. Higher autistic-like traits related to more reflective responses, although there were no group differences in this measure. Together, the results support the Dual Process Theory of Autism and suggest ASD is characterised as being less intuitive and more deliberative than controls. Intuitive responses are incorrect responses, however, the group difference was identified controlling for NVIQ, indicating that more intuitive responding is not solely due to generally lower levels of reasoning ability in ASD.

80 **161.080** Investigating the Predictive Impairment in Autism Hypothesis.

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Background: The human brain extracts probabilistic information from relations between events in the environment. Such learning underlies our ability to anticipate changes. The Predictive Impairment in Autism (PIA) hypothesis, recently proposed by Sinha and colleagues, posits that impaired ability to detect probabilistic regularities over time may be a key cause of seemingly unrelated symptoms in autism (e.g., social, language, and motor impairments). The Weather Prediction Task (WPT) is a probabilistic learning task that serves to test this hypothesis. Besides revealing behavioral performance differences, it also allows the study of the function of cerebellar and frontostriatal circuits in prediction while eliminating the potential confounds of social rewards. The functional integrity of neural substrates of skill- and probabilistic-learning in autism are not known.
Objectives: To assess: 1) Performance of individuals with autism spectrum disorders (ASD) on the WPT and 2) Differences between prediction-evoked neural activations in ASD and typically developing (NT) participants.
Methods: Participants were age and gender-matched ASD and NT adults with average range IQ. Each participant completed the WPT, which requires gradual integration of probabilistic information, outside and in an MRI scanner. During behavioral trials, the participant sees a combination of 1-3 cards from a set of 4 cards and indicate via button press either sunny or rainy weather outcomes with immediate feedback. Each card is probabilistically associated with a unique predictive value (likelihood) of sunny weather. Some cards have high predictive value, but none is a deterministic indicator of outcome. Through repeated presentations, participants learn the predictive value of cards to estimate weather outcomes. Responses are considered accurate when a participant selects the weather most highly associated with the probability of the combination of cards presented. Thus the accuracy reported represents the ability to build a probabilistic model for each card across a number of trials. Participants first complete a 200 trial behavioral training session, followed by 64 trials (without feedback) during fMRI scanning.Â A deterministic control task in the scanner presents a combination of 1-3 cards with either sunny or rainy symbols and requires participants to choose the weather in a 2AFC setting.
Results: During training, group performance significantly differed [$t(14)=2.70$, $p = .0097$] favoring NTs (M=66%, SD=0.06) compared to ASDs (M=58%, SD=0.06). During fMRI, the NT group showed greater activation for experimental vs control tasks, and increased activation compared to ASD in the thalamus, the basal ganglia (caudate and putamen), and in the 'social brain' (TPJ, STS, vmPFC, IFG, anterior insula, temporal pole, and amygdala). Importantly, this finding was partly driven by greater activation during the control task in ASDs versus NT participants.
Conclusions: The WPT is a non-social prediction task that can reveal both behavioral and functional differences in ASD. This task did not reveal cerebellar differences in the pilot group, but revealed decreased activation in frontostriatal circuits and in the so-called social brain in ASD. This study offers preliminary evidence for PIA hypothesis by demonstrating prediction deficits behaviorally and hypoactivation in systems that rely on predictive learning capacity distinct from known deficit areas in ASD.

81 **161.081** Looking Beyond Looking Time: A Systematic Review of Eye-Tracking Measures of Social Attention in ASD

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Background:
Eye-tracking technology has been a powerful tool for investigating social attention in ASD (Guillon et al., 2014). The majority of measurements of social attention have relied solely on looking time measures, interpreting longer looking times as an indication of preference for a certain area of interest (AOI). Based on this measurement it has been shown that social attention is reduced in individuals with ASD as compared to typically developing controls, ASD individuals directing less of their visual attention to social stimuli than typically developing controls (for a meta-analysis see Chita-Tegmark, 2016). However, there are many questions regarding social attention that cannot be answered through looking time measures, such as: do individuals with ASD prioritize social attention in the same way and to the same degree as typically developing controls? Do individuals with ASD explore the visual social world to the same extent? Do individuals with ASD maintain the same kind of focus on social stimuli as typically developing controls? Fortunately, eye-tracking technology makes possible a large number of different kinds of measures that can be used to tackle a variety of questions related to social attention in ASD.
Objectives:
The objective of this research is to systematically examine the eye-tracking literature in order to create an inventory of the available eye-tracking measures and to synthesize the findings they have enabled pertinent to social attention in ASD.
Methods:
A thorough search of the PubMed database was performed using the Boolean phrase ((ASD) OR (autism) OR (Asperger)) AND ((eye-tracking) OR (eye tracking) OR (eye gaze)). Articles meeting the following criteria were selected: 1) the article was an empirical study 2) the study compared individuals with ASD with TD controls 3) the study used eye-tracking technology 4) the study involved social stimuli 5) the study had a free viewing task and 6) the study included a measure in addition to and/or other than looking time. All eye-tracking measures of social attention were catalogued and the results obtained by means of these measures were synthesized.
Results:
The measures fell into three major categories: measures of prioritization of social attention (including: location of first fixation, latency to first fixation and progression of exploration over time), measures of persistence of social attention (including: average fixation time, characteristics of first fixation and visual perseverance) and measures of exploration of social information (including: saccade length, saccade paths characteristics, number of saccades and spread of fixation). A preliminary synthesis of findings suggest differences between individuals with ASD and typically developing controls for each of these major features of social attention, with less prioritization of social information, less persistence of social attention and less exploration of social information.
Conclusions:
By harnessing the full potential of eye-tracking technology and research in terms of available measures it is possible to gain a more nuanced understanding of social attention in ASD.

82 **161.082** Memory Deficits for Faces and Non-Social Stimuli in Children with ASD

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Background: The ability to remember faces is important for normal social communication. Despite mounting research on face processing deficits in children with autism spectrum disorder (ASD), little is known about their face memory deficit, particularly regarding its domain-specificity and the impact of memory demand. Moreover, the relation between the face memory deficit and affect processing in ASD has not been thoroughly researched, although the emotion recognition deficit is a key diagnostic criterion. Hence, a systematic investigation of the face memory deficit and its relation with affect processing in ASD is desired for improving diagnosis and treatment of affected individuals.
Objectives: This study aimed to investigate (a) whether children with ASD show a specific memory deficit for faces compared to non-social objects, (b) whether memory demand (i.e., time delay) affects memory performance in children with ASD, and (c) whether memory for faces is associated with affect processing.
Methods: Preliminary analysis on a sample of 8 children with ASD and 10 typically-developing (TD) controls (age range=8-12 yrs, *M*=10.72 yrs) is presented below.Â Memory for faces and non-social stimuli was assessed using (a) Memory for Faces and Memory for Designs subtests (both immediate and delayed) from the Developmental Neuropsychological Assessment Battery (NEPSY-II), and Faces and Dot Locations subtests (both short and long delay) from the Children's Memory Scale (CMS). Affect processing was assessed using the Affect Recognition subtest from NEPSY-II. Standardized scores of all these assessments were used.
Results: Â A 2x2x2 ANOVA with Domain (Face vs. Non-social), Delay (Short vs. Long), and Group (ASD vs. TD) on the NEPSY-II Memory for Faces and Memory for Designs subtests revealed a significant effect of group, $F(1,16)=15.13$, $p<0.001$, indicating overall lower memory ability in children with ASD ($M=9.47$) compared to TD children ($M=12.63$). No other main effects or interactions were significant. This result was replicated on the CMS Faces and Dot Locations Memory subtests; a 2x2x2 ANOVA with Domain (Face vs. Non-social), Delay (Immediate vs. Long), and Group (ASD vs. TD), $F(1,16)=6.71$, $p<0.02$, showed inferior memory performance in ASD children regardless of domain and time delay. Further correlation analysis found a significant correlation between long delayed face memory and affect recognition scores on NEPSY-II across all individuals, $r(16)=0.647$, $p<0.004$, and a significant relation was only observed in TD, $r(8)=0.774$, $p<0.009$ but not ASD, $r(6)=0.058$, $p=0.891$.
Conclusions: Although further analysis with a larger sample size is needed to corroborate these findings, current preliminary analysis revealed impaired memory for faces in children with ASD compared to their TD peers. However, this deficit was not specific to faces, and memory demand had no effect on its severity. Rather, children with ASD appear to have a general memory deficit across social and non-social domains. Furthermore, face memory seems to associate with affect processing in TD, but this relationship is likely to be disrupted in children with ASD.

83 **161.083** Memory Profiles Between Individuals with ASD with High or Low Cognitive Abilities: A Cautionary Tale about Generalizing Across the Autism Spectrum.

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Background: Findings from studies of individuals with high functioning autism are often generalized to the entire spectrum that includes individuals with a broad range of intellectual abilities, as well as varying levels of symptoms.
Objectives: The aim of the present study was to add to the discussion about the practice of generalizing across the autism spectrum by directly comparing the memory profiles of individuals with autism who were grouped according to cognitive abilities on a standardized measure of memory.
Methods: 37 children with an autism spectrum disorder with both high (HCA) and low cognitive abilities (LCA) were tested on a non-verbal IQ test, and a subset of these (n = 17) also completed the conormed attention and memory battery of the Leiter-R (Roid & Miller, 1997).
Results: Profiles of scores were examined via both traditional null hypothesis testing, as well as Bayesian analysis, since evidence of group differences in patterns of performance would be reflected in a lack of differences between the HCA and LCA participants. The findings suggest similarities in patterns of cognitive strengths and weaknesses but clear difference in terms of memory profiles. Using Bayesian analyses, we confirm that HCA and LCA did not differ in terms of their recognition memory skills. Examination of standard scores suggest that while recognition memory might be a weakness for HCA participants, this was not the case for the LCA group.
Conclusions: These findings suggest that researchers should be cautious when making generalizations to the entire spectrum, as recognition memory weaknesses noted in the HCA group were not reflected in the LCA group. These findings also provide further support for the use of non-verbal tests in assessing the performance of individuals with autism with lower cognitive abilities.

84 **161.084** Memory for Items, Contexts and Relations in Adults with Autism Spectrum Disorder

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Background:
Two prominent accounts of memory difficulties in adults with Autism Spectrum Disorder (ASD) suggest difficulties in episodic memory (Bowler et al., 2007) and complex memory (Williams et al., 2015). Both accounts implicate problems remembering relations between items or between items and their context (Bowler et al., 2015), and difficulties in these areas may be the result of problems in binding items to one another, in binding items to their context, or in forming a three-way relation between two items and their context (ternary relations; Halford, 1992). Recent research has shown a developmental progression in typical children's ability to recombine items and context as well as to form relations between three components such as two items and their context (Yim et al., 2013). Forming and retaining connections between items and context have recently been identified as the prerequisites for the development of episodic memory (Yim et al., 2013), and they may be a component of autistic individuals' difficulties in this area.
Objectives:
This study aimed to use Yim et al.'s (2013) paradigm to identify the components in the memory binding process that are most difficult for ASD individuals and to point to potential compensatory mechanisms.
Methods:
Fifty-four pairs of ASD and typically developing (TD) individuals matched on gender, chronological age (CA; M_{CA} = 43.19), and intelligence quotient (IQ; M_{FIQ} = 111) were tested on one of three associative learning tasks that varied in the number of bindings between items and context to be formed for task success. One group of participants studied lists of word pairs in the form of AB CD, where each list contained different pairs of items such as *tree-shoe* (AB) and *strawberry-sofa* (CD). A second group of participants studied lists of the form AB AC, which recombined familiar items from the first list with new items in the second list, for example, *bicycle-cup* (AB) and *bicycle-nail* (AC). A third group studied AB ABr lists, where the first studied list (AB) contained pairs such as *door-glass* and *flag-balloon*, and the second set (ABr) presented a recombination of item-pairs from the first list introducing no new items, for instance, *door-balloon*. Each list was accompanied by a specific contextual cue.
Results:
Overall accuracy was lower for persons with ASD compared to TD individuals on all tasks ($F(1,102) = 12.49$, $p = .001$). A multinominal model (Kim et al., 2013), using error rather than accuracy data showed that ASD participants named more items that were unrelated to the studied items, they more often confused item-item relations, and they showed particular difficulties in binding item-pairs to their contextual cue. These last two findings reflect ternary binding difficulties. However, ASD participants performed better than TD individuals in distinguishing between the two studied lists, i.e., identifying whether individual items belonged to a cue or a target list.
Conclusions:
This study confirms particular difficulties in ASD in forming ternary relations in memory. However, it also suggests that persons with ASD rely on their superior capacity to remember item-list relations as a compensatory mechanism.

85 **161.085** Meta-Analysis of Eye Gaze Differences to Social and Non-Social Information Between Individuals with and without Autism

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Background:
Numerous studies have emphasized abnormal eye gaze as a key characteristic in individuals with autism. However, a limited number of findings have been replicated, the magnitude of effects is unclear, and the pattern of gaze differences across stimuli requires further investigation. Eye gaze studies offer a unique window into the selection of information for attention and cognitive processing. As such, findings across studies can inform disparate cognitive theories of autism, including the distinction between specific deficits in social-emotional cognitive processing versus more general non-affective cognitive dysfunction.
Objectives:
The first aim of the present study was to conduct a comprehensive multivariate meta-analysis of autism eye tracking studies to establish whether gaze differences relative to healthy and developmental disability controls are present and to determine the magnitude of these differences. The secondary aim was to evaluate the influence of specific study demographic and methodological factors influencing eye gaze differences. Specifically, we were interested in the magnitude of differences across different stimuli and regions-of-interest (ROIs) as this may inform cognitive theories of autism.
Methods:
A comprehensive search was completed using PubMed supplemented by a manual search. 1132 publications were initially identified for closer inspection. Inclusion and exclusion criteria were applied to identify only those studies reporting sufficient information to compute effect sizes comparing individuals with autism to healthy or developmental disability controls on eye gaze measures of fixation or looking time. A wide range of study demographic, clinical, methodological, stimulus, and ROI characteristics were coded. A blinded second rater coded 10 studies representing 62 group comparisons. Inter-rater reliability was consistent for each variable (K=.81-1.00, absolute agreement=91.3%-100%).Â An initial methodological mixed-effects meta-regression model was estimated with study characteristics as moderators. Next, a conceptual multivariate mixed-effects meta-regression model examined the impact of stimulus and ROI features while adjusting for significant methodological characteristics from the initial model.
Results:
The search revealed 122 independent studies with 1155 comparisons. Estimated effect sizes tended to be small-to-medium, but varied considerably across studies. Meta-regression of methodological factors indicated lower effect sizes for studies with higher method quality, later publication years, and using developmental disability control comparisons. Effect sizes did not vary as a function of sample age. The conceptual meta-regression identified that non-social ROIs yielded larger effect sizes than social ROIs (Figure 1). However, eye and whole face regions within stimuli depicting human interaction produced the largest effects (Hedge's g=.47 and .50). Overall, studies with weaker methodology obtained larger effects, but effects remained significant and medium-sized for studies with moderate and high rigor designs.
Conclusions:
Individuals with autism show a reliable pattern of eye gaze abnormalities that suggests a problem with basic discrimination of irrelevant non-social from socially-important information. This difference appears to be persistent across age and worsens during observation of human interactions. These findings support social processing deficits as a core feature, consistent with social cognitive theories of autism. Eye gaze abnormalities in autism were of sufficient magnitude that, if combined across stimuli and ROIs, could yield clinically-useful risk assessment and serve as quantitative, objective outcome measures.

86 **161.086** Metacognition, Mindreading, and the Hypercorrection Effect in ASD

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Background: Â Among neurotypical adults, errors made with high confidence (i.e., errors a person strongly believed they would not make) are corrected more reliably than errors made with low confidence.Â This "hypercorrection effect" is thought to result from enhanced attention to information that reflects a "metacognitive mismatch" between one's beliefs and reality.Â This effect is thought to be tied to metacognitive monitoring ability (awareness of one's own thoughts/cognitive states).Â Theoretically, metacognitive monitoring is itself considered to be related to mentalizing/mindreading ability (awareness of others' mental states).Â Although mindreading is well-known to be impaired in ASD – thus providing grounds to predict metacognitive monitoring and the hypercorrection effect will be also – studies have only recently begun to explore metacognition, and its relation to mindreading and ASD features/traits, in this disorder.
Objectives: Â This study addressed three central questions, two of which were entirely novel (1 and 3) and one of which (2) provided new evidence about a phenomenon only recently-studied in ASD:
1) What is the relation between metacognitive monitoring ability and a) mindreading ability, and b) ASD traits?
2) To what extent is metacognitive monitoring is impaired in ASD?
3) To what extent do children with ASD show a hypercorrection effect?
Methods: In Experiment 1, n = 83 neurotypical participants answered general knowledge questions and provided confidence judgements about how likely each answer was to be correct, after which feedback (i.e., the correct answer) was given. Finally, participants were retested on all questions answered incorrectly during the initial phase. Mindreading ability (Reading the Mind in the Eyes) and ASD-like traits (Autism-spectrum Quotient) were also measured. In Experiment 2, so far 11 children with ASD and 11 age- and IQ-matched comparison participants have completed the hypercorrection task.
Results:
In Experiment 1, participants made accurate confidence judgements (i.e., a close correspondence between confidence in their answers to questions and actual success on those questions, reflecting good metacognitive monitoring) and showed the hypercorrection effect (high confidence errors initially more likely to be corrected at retest than initial low confidence errors). Mindreading ability was associated significantly with metacognitive monitoring ($r = .27$, $p < .01$) and ASD-like traits ($r = -.35$, $p < .001$). However, the hypercorrection effect was non-significantly associated with mindreading ($r = -.16$, $p = .88$) and ASD-like traits ($r = .08$, $p = .45$). In Experiment 2, children with ASD children are showing a large and significant diminution of metacognitive monitoring ability, $t(20) = 2.00$, $p = .03$, $d = 0.86$, yet a non-significantly larger hypercorrection effect than comparison participants, $t(20) = 0.57$, $p = .58$, $d = 0.25$. The evidence in favour of an undiminished hypercorrection effect (null result) is moderate, according to Bayesian analysis (Bayes factor = 0.21).
Conclusions: These results provide support for the theory that metacognitive monitoring and mindreading are linked, and confirm that both are diminished in ASD. The hypercorrection effect appears normal in ASD, however, and does not rely on the same metarepresentational resources as metacognitive monitoring and mindreading. The implications for theory and educational practice will be discussed.

87 **161.087** Minecraft Working Memory Task: Considering Content in the Working Memory Abilities in School-Age, Higher-Functioning Children with Autism Spectrum Disorders

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Background: Higher-functioning children with ASD (HFASD) often experience working memory (WM) problems (Geurts, de Vries, van den Bergh, 2014). These difficulties can be similar to those observed in children with ADHD (Geurts et al., 2004). Incorporating specific interests—such as video game content—into WM tasks may affect WM outcomes in both clinical groups but for possibly different reasons.
Objectives: Our study examined WM abilities in 9–18-year-old school-age children with HFASD compared to children with ADHD or typical development (TD) across two types of memory tasks—two standardized WM tasks and an experimenter-constructed task based off the video game Minecraft. This study examined the hypothesis that children with HFASD will perform better than controls on a memory task incorporating items of interest compared to performance on content-irrelevant WM measures. An alternative hypothesis is that children with HFASD demonstrate difficulties on a content-specific task due to syndrome-specific difficulties in WM.
Methods: The participants were 71 children with HFASD, 31 children with ADHD, and 38 children with TD. ASD symptoms were confirmed with the ADOS–2; ADHD symptoms were confirmed with the Conners-3. IQ was assessed with the WASI-II. WM abilities were assessed with Story and Verbal WM assessments of the Wide Range Assessment of Memory and Learning-2. The Minecraft WM task required participants to watch a 2-minute clip of Minecraft gameplay and to retell the video to an experimenter; participants were scored across a list of 35 possible items. Minecraft familiarity was assessed by self-report on a questionnaire.
Results: A MANCOVA controlling for IQ revealed a Diagnostic Group effect on WM measures, $F(4,270)=3.84$, Wilks' $\Lambda=.90$, $p=.005$, partial $\eta^2=.05$. Univariate effects were observed for Story Memory, $F(2,136)=5.61$, $p=.005$, partial $\eta^2=.08$; pair-wise comparisons with Sidak corrections indicated that the HFASD group performed significantly lower than the TD group ($p=.003$). No univariate effects were observed for Verbal WM. Almost all participants across groups reported being familiar and knowing about Minecraft (97%, 100%, and 100% for HFASD, ADHD, and TD, respectively). Within the HFASD group, VIQ ($r=.43$, $p<.002$), ADOS-2 Total score ($r=-.41$, $p<.002$), and Story Memory ($r=.55$, $p<.002$) were correlated with the Minecraft Recall score; these significant correlations remained after controlling for age. Within the ADHD group, only age ($r=.44$, $p=.02$) and Story Memory ($r=.58$, $p=.001$) were significant. An ANCOVA controlling for age revealed a Diagnostic Group effect on Minecraft recall score, $F(2,136)=5.53$, $p=.005$, partial $\eta^2=.08$; the HFASD group performed significantly lower than the TD group ($p=.003$) but did not differ from the ADHD group.
Conclusions: This study demonstrated that children with HFASD display syndrome-specific WM difficulties regardless of the content of the WM task. The HFASD group demonstrated significantly lower performance on both the Story Memory scale and the Minecraft Recall task; Minecraft Recall performance in HFASD was related to verbal IQ, story memory, and ASD symptoms, while the performance in ADHD was related to story memory and age. Our study suggests that the memory difficulties observed in HFASD may be due to syndrome-specific impairments regardless of the task content.

88 **161.088** Predicting Math Achievement from Attentional Ability and Perceptual Reasoning in Students with Autism Spectrum Disorder

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Background: Children and adolescents with Autism Spectrum Disorder (ASD) often present a profile that includes academic difficulties compared to their typically developing peers (Ashburner, Ziviani, & Rodger, 2010). Early math skills are an integral component to academic success and can be used to predict future achievement (Claessens & Engel, 2013). Although domain-specific numerical skills and knowledge are critical for success in mathematics, cognitive factors also play important roles in math proficiency. In particular, domain-general attentional skills, such as concentration and working memory, have been found to be factors contributing to differences in mathematics achievement (Cragg & Gilmore, 2014). Research involving these skills can clarify the degree to which attention contributes to the math abilities of individuals with ASD. A better understanding of this relationship can lead to the development and implementation of academic interventions in the form of attention training programs aimed at far-transfer to improvement of mathematics ability.
Objectives: Â The purpose of this study is to assess the contribution of attention to math achievement within the context of a school-based study, and to determine the role of perceptual reasoning in this relationship. The objectives are two-fold: (i) determine whether the math proficiency of children with ASD can be predicted by performance on a clinical test of attention, and (ii) measure whether perceptual reasoning intelligence acts as a covariate in the relationship between attention and math.
Methods: All participants (N = 99) completed measures of attention, intelligence and math. The participants were grouped by diagnosis; ASD and non-ASD neurodevelopmental disorder. Attention was assessed using the Conner's Continuous Performance Task, Third Edition (CPT-3). The Wechsler Abbreviated Scale of Intelligence (WASI)-II was used to assess intelligence, Non-Verbal Perceptual Reasoning Index (PRI) and Verbal Comprehension Index (VCI). Lastly, the Pearson KeyMath was used to assess math ability.
Results: The results of a one-way ANOVA indicate that students diagnosed with ASD performed significantly higher on KeyMath than students with a non-ASD neurodevelopmental disorder, $p = .016$. The results of a separate ANOVA indicate that individuals with ASD also performed significantly higher on tests of attention, $p = .014$, as well as perceptual reasoning, $p < .001$. All variables were significantly correlated with each other (PRI, CPT-3 and KeyMath), $p < .001$ for all correlations. The PRI score of the WASI-II (a measure of non-verbal fluid abilities) served as a significant mediator in the relationship between attention and math ability in students with ASD, but not for students with a non-ASD diagnosis.
Conclusions: The results of this study indicate that math proficiency can be predicted by attention for students diagnosed with ASD. Furthermore, PRI serves as a significant mediator in the aforementioned relationship for students with ASD only. The results help to gain a better understanding of the cognitive and academics profile of individuals with ASD, specifically in terms of the selective influence of attention capability and non-verbal intelligence. These results provide the theoretic foundation for choosing non-verbal assessment and remediation approaches for students with ASD.

89 **161.089** Preference for Nonsocial Realistic Movement in Children with ASD

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Background: From infancy children orient to social information as supported by evidence of preference for and orienting to both faces and biological motion. In ASD, patterns of visual attention for socially based stimuli often differ from typically developing peers. In particular there is evidence for a lack of orienting to biological motion (Klin et al., 2009) and a preference for non-biological motion in the form of geometric patterns (Pierce, et al., 2011).
Objectives: To examine whether diminished orienting to motion is specific to socially based motion or a general diminished orienting to realistic motion.
Methods: Participants were 19 children (Female = 4) with ASD ranging in age from two to five years (M = 4.24, SD = 1.12). Stimuli consisted of a total of 20 5-second movie clips of social or object based motion with no sound. Social movies were male and female children in the age range of the study sample engaging in a variety of movements like jumping, dancing, and waving their arms. Object movies were a range of objects moving independently like a remote control bus driving, a record spinning, and marbles going down a marble tower. Control stimuli were created by blurring the social and object movies, retaining color, brightness and amount of movement, but were not obviously movement from everyday life. Participants viewed each clip simultaneously (side by side) with the blurred version of itself on a 22"" computer screen. Children's gaze shifts were monitored with an SMI REDn Remote Eye-Tracking system. Looking time was measured as visual fixations, defined as ≥100 ms of continuous gaze to a 100 pixel area, and saccades within the visual area of each video presentation. Preference for the blurred video was calculated as looking time to the blurred video over looking time to both the blurred and real movement videos. Preference was averaged across 10 trials within each condition. Trials with less than 200 milliseconds of looking to either video were excluded.
Results: One-sample t-tests with a test value of .5 revealed that in the object condition, participants demonstrated a preference for the object movement versus the blurred video (M = 0.38, SD = 0.11, t(18) = -4.79, p < .0001). In the social condition participants' preference was not significantly different from chance (M = .52, SD = 0.15, t (18) = 0.71, p = .49).
Conclusions: This paradigm demonstrated the presence of a preference for realistic motion when that motion is non-biological. These results suggest that orienting to biological motion may be a domain specific deficit. Next steps are to examine relationships between preference and measures of ASD symptoms, as well as to compare performance on this task to children with developmental delays and typically developing children.

90 **161.090** Preliminary Findings in Adolescents with ASD: Pupil Diameter As a Proxy for Cognitive Load during Passive Viewing of Facial Expression Stimuli

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Background: Â Pupillometry, a method for indirectly measuring neural firing within the locus-coeruleus norepinephrine (LC-NE) system, has long been usedÂ as aÂ proxy for measuring arousal and visual attention. In recent years, it has been established that changes in pupil dilationÂ are associated with cognitive demand in typical populations. Pupil diameter increases as demands on visual attention increases, and as general cognitive tasks increase in complexity. As cognitive load increases, pupil diameter will increase regardless of accuracy of the participant's response. Within ASD, it is well known children and adolescents demonstrate diminished attention to faces. It is not clear, however, whether there is a difference in cognitive demand between typically developing individuals and those with ASD while visuallyÂ processing facial stimuli depicting emotion.
Objectives: Â This study examined theÂ pupillary changesÂ in two groups of adolescents, typically developing (TD), and those with ASD without language impairment, upon passive viewing of facial expressions. The aim of the study was to demonstrate differences in pupil diameter between groups, serving as a proxy for measuring the cognitive demand associated with passive visual processing of facial expression stimuli. We hypothesized that the ASD group would demonstrate greater average pupil diameter while passively viewing facial expressions when compared to average pupil diameter within the typically developing group.
Methods: Participants sat at a stationary eye-tracking station with chin positioned in a chin rest. NimStim photos (Tottenham, 2009) were presented on a computer monitor for 4000 ms each, within 2 randomized blocks. Participants were told to look at the face on the monitor. Binocular infrared eye tracking recorded the changing pupil diameter in response to passive viewing of the facial expression stimuli.
Results: A significant difference in average pupil diameter was observed between groups. We ran a two-tailed, bi-directional t-test, which suggested the mean pupil size was smaller for the TD group (M=.0043, SD=.00040) than for the ASD group (M=.0052, SD=.00051) (t(38)=6.408, p<.000001). When considered in the context of cognitive demand and pupillary dynamics, this observation suggests the likelihood of greater allocation of cognitive resources by the adolescents in the ASD group during visual processing of facial expressions. The ASD group demonstrated greater average pupil diameter, suggesting the increase in pupil dilation may be associated with greater demands of attentional resources while examining the human face.
Conclusions: The relative increase in average pupil diameter within the ASD group suggests measurement of changes in pupil diameter may serve as a proxy for cognitive load when viewing visual stimuli. This population may use increased cognitive effort to process common facial expressions and the pupil response provides a physiologic measure of visual processing in relation to cognitive demand. These results have implications for treatment targeting non-verbal language use. These findings also support further analysis using an "index of cognitive ability" algorithm (Bartels & Marshall, 2012)Â to measure changing pupil diameter as a covariate when examining visual processing of facial expressions within the ASD population.

91 **161.091** Profiles of Academic Achievement in Children with Autism Spectrum Disorders with Monolingual and Bilingual Language Experience

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Background:
Although research has shown that children with ASD with can demonstrate comparable academic skills with their typically developing peers (Mayes & Calhoun, 2008), no research to date has assessed the impact of diverse experiences on academic achievement in children with ASD. Research with typically developing bilingual children find that although English-language learners may lag behind their monolingual peers on measures of academic achievement (Han, 2012), these gaps can be minimized with bilingual programs (Rolstad, Mahoney, & Glass, 2005). Despite these studies on academic achievement in children with ASD and bilingual children, it is unclear whether these patterns will hold for bilingual children with ASD.
Objectives:
The present study aims to clarify the impact of diverse language experiences on academic achievement in diverse children with ASD.
Methods:
The current study is part of a larger study evaluating developmental profiles of diverse children with ASD who visited a developmental disabilities clinic located in an urban city in the United States. Clinic records of children between 3 and 12 years of age with clinical diagnoses or educational classifications of an Autism Spectrum Disorder were reviewed. Information about demographics, language experiences, nonverbal IQ, and subtest scores for Wechsler Individual Achievement Test (WIAT; Wechsler, 2001) were extracted from the clinic records. Children were grouped by their language use as monolingual or bilingual based on clinician observations, parent-report of language use in the home and school and language use reported in children's IEP reports.
Results:
Cases were included in the current analyses if children with ASD had data available for at least three WIAT subtests: Word Reading, Numerical Operations, and Spelling. Preliminary analyses included 17 monolingual children and 11 bilingual children. No differences were found in age, age of first diagnosis, and nonverbal IQ (all *p*'s > .05) between groups. Additionally, the two language groups were comparable in the proportion of males and percentage receiving public aid, see Table 1. To examine academic achievement profiles of monolingual and bilingual children with ASD, a repeated measures ANOVA was conducted with WIAT subtests (Word Reading, Numerical Operations, Spelling) as a within subjects variable, and Language Group as a between subjects variable. These analyses found a significant WIAT subtest X Language Group interaction, $F(2, 52) = 3.62$, $p = .034$, partial $\eta^2 = 0.12$. The results of the significant interaction are displayed in Figure 1. Follow-up t-tests found no significant differences between monolingual and bilingual children with ASD on individual WIAT subtests (all *p*'s > .05).
Conclusions:
Although the preliminary results found a significant interaction between language group and WIAT subtests, follow-up tests revealed no differences between groups. However, the results also indicate that monolingual and bilingual children perform similarly on standardized measures of academic achievement, indicating that learning two languages may not have a detrimental effect on the cognitive development of children with ASD. These results provide initial evidence on the impact of language experience on academic achievement, adding to the limited literature on bilingual language development in ASD.

92 **161.092** Pupil Adaptation Corresponds to Quantitative Measures of Autism Traits in Children

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Background:
The pupil is known to reflect underlying neurologic function as well as a range of psychological and physiological variables, including cognitive effort, arousal, attention, and even learning. Within autism spectrum disorder (ASD), several studies have found atypical pupil size and/or atypical pupil response profiles relative to control populations. As we have come to understand the heterogeneity of ASD and other neurodevelopmental disorders, the relationship between quantitative traits and physiological markers has become increasingly more important, as this may lead us closer to the underlying biological basis for atypical responses and behaviors.
Objectives:
Here, we implement a novel paradigm designed to capture patterns of pupil adaptation during sustained periods of dark and light conditions. We also investigate the relationship between pupil metrics derived from this novel task and quantitative behavioral traits associated with the autism phenotype.
Methods:
Our sample included children seen at a neurodevelopmental clinic, including those with and without an ASD diagnosis, as well as those with other diagnoses (ADHD, ODD, fetal alcohol syndrome); N=42 children, ages 5 to 16 years (mean age= 8.95 ± 2.59; n=21 males; average FSIQ= 104.45 ± 17.60). Participants were characterized using a phenotyping battery that included the Social Responsiveness Scale-2nd Edition (SRS), a parent-report measure that assesses quantitative impairments in social awareness, cognition, communication, motivation, and repetitive behavior/restricted interests that define ASD. Participants completed a passive viewing eye tracking task during which alternating dark (black screen) and light (white screen) stimuli were displayed. Stimuli included a 5-second black screen and a 5-second white screen that alternated across trials. Dependent variables of interest included: (1) the amplitude of dilation or constriction across each condition and (2) the latency to reach maximum dilation or constriction across each condition. Baseline pupil diameter was also extracted for each participant.Â
Results:
This task evoked characteristic constrictions and dilations during light and dark conditions, respectively, as expected based on pupil physiology. Further, the amplitude of dilation was correlated with SRS Total t-score (p=0.007), as well as SRS subscores (all p's<0.02). The amplitude of constriction showed a similar relationship with SRS scores (all *p*'s<0.02). Latency was not as reliable in predicting SRS scores. Importantly, baseline pupil diameter was not related to SRS scores (all p's > 0.16).
Conclusions:
These results suggest that using our novel, yet simple, paradigm can result in meaningful pupil metrics that correlate with individual differences in autism traits, as measured by the SRS.Â One key difference between our paradigm and studies of the pupillary light reflex is the sustained nature of our stimulus presentation. This sustained presentation may contribute to capturing meaningful individual differences in pupillary physiology that is relevant to quantitative traits associated with the autism phenotype. These results contribute to a growing body of literature that implicates basic visual sensory anomalies in atypical social-communication deficits associated with autism.

93 **161.093** Reaching the Other Half: Executive Function Deficits in a Community Based Sample

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Background: Most ASD research recruits individuals with prior diagnoses, limiting generalizability to families who have sought care, which is particularly problematic for low resource families (Durkin et al., 2015). Our group has previously reported on children recruited based on symptomology, rather than prior diagnosis (Kraper et al., poster at 2016 IMFAR conference), finding that while clinician observation of ASD symptoms was similar between children previously diagnosed with ASD and those who were not, parents of children without any prior diagnosis reported fewer symptoms. The current study follows up on that same group of children to report the degree that parents recognized problems with executive functioning (EF).
Objectives: To compare EF skills in children meeting criteria for ASD on the ADOS-2 with a prior ASD or comorbid ASD and ADHD diagnosis to those with a prior ADHD diagnosis or no prior diagnosis.
Methods: Families at high-poverty schools in the broader Washington, DC area were referred to participate in a comparative effectiveness trial of two school-based EF interventions. The current study uses a subsample of this population meeting criteria for ASD on the ADOS-2 for whom parents reported on prior diagnostic status. Specifically, this included 39 children (mean age=9.8 years, SD=0.79) of whom 12 had a prior ASD diagnosis, 7 had prior comorbid diagnoses of ASD and ADHD, 10 had a prior ADHD diagnosis, and 10 had no prior diagnosis. EF was measured by parent report on the BRIEF, clinician observations of skills in the classroom, and teacher report of classroom performance.
Results: Clinician Comparison Score rating of social communication and restricted interests/repetitive behaviors on the ADOS-2 did not differ between the four groups ($F_{3,35}$=1.67, *p*>.05). The groups also did not differ on age, Full Scale IQ, family income, or child's ethno-racial category. Parent-reported level of EF problems on the BRIEF differed significantly between groups ($F_{3,35}$=8.443, p<.01). Post-hoc comparisons showed children with prior comorbid diagnoses had significantly higher levels of parent-reported EF problems than children with a prior ASD diagnosis (Sheffe's *p*=.004) or no prior diagnosis (Sheffe's *p*=.002). The children with a prior ADHD diagnosis had significantly higher levels of parent-reported EF problems than children with no prior diagnosis (Sheffe's *p*=.047). Despite differences in parent report of EF problems, there were no differences in clinician observations of classroom behaviors ($F_{3,35}$=.365, p>.05) nor in teacher report of classroom performance ($F_{3,24}$ =.665, p>.05).
Conclusions: Greater levels of EF problems were reported by parents of children with prior comorbid diagnoses of ASD and ADHD or a prior ADHD diagnosis, suggesting that parent-report of EF problems resulted in a diagnosis of ADHD, either alone or in combination with ASD. In contrast, blind observations of classroom behaviors and teacher report of concerns were similar, indicating comparable functional impairment from EF problems at school across groups. This suggests the importance of multiple methods of gathering information for accurate diagnosis (e.g., parent-report, teacher-report, observations). Further research should continue exploring factors related to difficulty accessing specialized ASD assessment and methods to identify children most likely to require those assessments.

94 **161.094** Retest Reliability of the N2 Event-Related Potential Component and Conflict Processing Behavioral Task in Children with High Functioning ASD

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Background:
Evidence indicates good retest-reliability of electrophysiological measures of performance monitoring in the anterior cingulate cortex (ACC) over time in healthy adolescents and young adults and moderate retest reliability of the conflict monitoring N2 component in a large group of healthy individuals (Segalowitz et al., 2010; Clayson & Larson, 2013). However, to our knowledge, no investigations have explored the retest reliability of this component in children, particularly those with autism spectrum disorders (ASD), which is important considering its recent uses as neural developmental measure of executive control (EC) (Espinet et al., 2011). In addition, we will investigate the retest reliability of a modified version of the Change Task as a behavioral measure of EC within the same subjects. Ultimately, it is critical to examine the retest reliability of both the N2 component and the Change Task as the psychometric properties of EC measures are often poorly understood but represent an important domain in the exploration of intervention and biomarkers of treatment response.
Objectives:
To determine the retest reliability of the N2 event-related potential component and a conflict processing behavioral task in children with ASD.
Methods:
The test-retest reliability was evaluated for the conflict monitoring N2 event-related potential (ERP) and for an adapted version of the Change Task, which measures inhibitory control, shifting and monitoring behaviors. ERPs were obtained from 10 children diagnosed with ASD between the ages of seven and eleven, while they completed a modified version of the Eriksen Flanker Task (Rueda et al., 2004). The N2 ERP was calculated from the mean amplitude in electrodes Fz and those directly adjacent (EGI GSN: 19, 4). All participants completed the Flanker task at two time points, around ten-weeks apart and eight of these participants completed the change task at two time points, also around ten-weeks apart.
Results:
Results showed that the differential N2 amplitude between congruent and incongruent trials was not reliable over the two time points, while evidence showed that N2 amplitude in congruent trials was reliable over the 10-week period (ICC of .88, $p < .05$). In terms of behavior, the modified change task showed strong 10-week test-retest stability in measures of inhibitory control (ICC of .74, $p < .05$), shifting (ICC of .85, $p < .05$), and monitoring behavior (ICC of .98, $p < .05$).
Conclusions:
Although we found that the differential N2 amplitude was not stable over the 10-week time period, we found the general N2 amplitude in congruent trials was. In addition, the Change Task showed retest reliability over the 10-week period within these same subjects. This suggests that that behaviorally these subjects did not exhibit improvements in EC as measured by the Change task, despite changes in the differential N2. This could suggest that the N2 measure isn't stable over time, or that the changes in neural EC perhaps, precipitate changes in behavior. Implications of this finding might be limited by our small sample size, which we anticipate will increase by at least a factor of two over the next few months.

95 **161.095** Sex Differences in Autistic Profiles in Preschool Children with Autism Spectrum Disorders.

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Background: Epidemiological studies have consistently shown that autism spectrum disorders (ASD) affect more males than females. Studies have reported that females with ASD have a different behavioral phenotype from that of their male counterparts. Females with ASD have a lower frequency of comorbid challenging behaviors and fewer abnormal special interests and concurrent socio-communication symptoms than males with ASD. They also have less externalizing and social problems and present fewer socio-communication symptoms. It has been suggested that there is a relative failure to diagnose females with ASD because of differences in the clinical presentation of ASD. The delay in (or complete absence of) diagnosis results in a failure of necessary support for females with ASD, which could create serious identity issues and higher levels of internalizing symptoms (i.e., withdrawal, somatic complaints, anxiety, and depression). Early identification and diagnosis of ASD in females are important, as they lead to earlier treatment, which is associated with improved developmental outcomes.
Objectives: The purpose of this study is to examine the sex differences in young subjects with ASD.
Methods: We examined sex differences in ASD among children under 6 years, using the Kyoto Scale of Psychological Development and the Childhood Autism Rating Scale-Tokyo Version (CARS-TV). Seventeen females with ASD were compared with 100 similarly diagnosed males.
Results: Although females and males with ASD showed similar cognitive profiles on the Kyoto Scale of Psychological Development, females with ASD demonstrated a different symptom profile from males with ASD on the CARS-TV. Females with ASD had a significantly higher "Taste, Smell, and Touch Response and Use" score than males with ASD.
Â Conclusions: The notable finding in this study was found in the CARS-TV, in which female subjects scored significantly higher than male subjects on "Taste, Smell, and Touch Response." This result may assist in planning early diagnosis as well as intervention methods for females with HFASDs who might have been under-recognized. Some researchers consider sensory symptoms to be a component of core ASD deficits. We propose that "Taste, Smell, and Touch Response and Use" may be useful for the early identification of ASD in females. The sex differences in "Taste, Smell, and Touch Response and Use" in our study, if replicated in other samples, could lead to the development of useful diagnostic tools, increasing service and therapeutic efficacy for female children with HFASDs. The presence of the unique autistic features identified in this sample of females should be replicated with a larger sample, and future research should clarify possible behavioral, neurological, and genetic links to these sex differences.

96 **161.096** Sex-Differences in Self-Reported Executive Functioning Problems in Youth with Autism Spectrum Disorder

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Background: Although the literature contains rich autobiographical accounts by individuals with autism spectrum disorder (ASD), there has been relatively little quantitative research utilizing self-report measures to describe the experience of having ASD. Such research amongst females with ASD is particularly rare, as it is estimated that ASD is diagnosed four times more often in males than in females. The Behavior Rating Inventory of Executive Function (BRIEF) is a questionnaire that has consistently revealed everyday executive function deficits, particularly inflexibility, in ASD. However, there are no prior studies examining self-reported real-world executive functioning utilizing the BRIEF in ASD. We have previously found sex differences in everyday executive functioning utilizing parent ratings from the BRIEF (White et al., IMFAR Panel, 2016).
Objectives: Examine sex differences in everyday executive functioning in ASD based on scores from the youth self-report version of the BRIEF. Compare parent and self-reports of everyday executive functioning using the BRIEF to look for discrepancies in self and informant ratings that may be sex related.
Methods: The present study included 22 females and 22 males with ASD who completed the BRIEF youth self-report, and who had a parent/guardian complete the BRIEF informant report. Females (mean age = 14.39 ± 2.18, IQ = 106.41 ± 17.46) and males (mean age = 14.38 ± 2.24, IQ = 106.14 ± 17.28) were individually matched within 5 full-scale IQ points. All subjects received an ASD diagnosis from trained and experienced clinicians applying DSM-IV/5 criteria which were confirmed based on scores from the Autism Diagnostic Observation Schedule and/or Autism Diagnostic Interview. Two mixed-model ANOVAs were run as follows:
1) sex (female, male) x BRIEF self-report scale (8)
2) sex (female, male) x rater (self, parent) x BRIEF scale (8)
Results: On the BRIEF self-report a significant interaction between BRIEF scale and sex (F = 2.75, p = .025) was observed. There were not sex differences on any given scale, indicating that the interaction effect reflects a diverging profile of BRIEF scores between males and females (see Figure 1). Comparing BRIEF self and parent reports, there is a strong main effect of rater (F = 55.19, p <.001), with parents rating significantly more executive function challenges across scales than did youth with ASD. However, there were not any sex-related differences in the degree of self vs. parent rated impairments.
Conclusions: In this report, we found evidence of sex differences on the BRIEF self-report in a well matched sample of youth with ASD. In line with previous findings on the BRIEF parent informant report, both males and females with ASD exhibited the highest scores on the Shift scale from the self-report measure. However, this finding is qualified by emerging sex differences in the profile of impairments across BRIEF subtests. As we continue ongoing data collection, we aim to delineate the intricacies of everyday executive functioning patterns in males and females with ASD.

97 **161.097** Sleep Related Behavioural and Cognitive Functioning

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Background:
Several factors have been outlined as having a negative impact on cognitive and behavioral functioning of individuals with Autism Spectrum Disorders (ASD). Sleep is the main focus of the current study since a number of studies reported that children with ASD experience severe sleep problems. Since sleep has been found to play an active role in children's memory consolidation, it is vital to assess the impract of sleep on children's functioning.
Objectives:
The study had two chief aims: primarily to examine sleep-dependent memory consolidation on children with ASD, and furthermore to provide insights on children's nocturnal sleep habits in relation to their cognitive abilities. Additionally, as Greece is a country in which napping is a common practice, diurnal sleep habits of children were assessed. Participants included, 12 typically developing (TD)and 12 children with ASD (5-16 years of age).
Methods: Sleep dependent memory consolidation was assessed using Animal Names task, a recently developed child-friendly and engaging declarative memory task. Sleep was further assessed using Childhood Sleep Habits Questionnaire, a napping questionnaire and actigraphy.
Results: Repeated measures ANOVAs were conducted to assess performance between the Animal Names task sessions (Test 1, 2, 3) across each group (TD, ASD) and sleep and wake condition. TD children had higher scores than the ASD children on all tests.
TD children had higher scores on the Animal Names task following intervals of sleep, rather than wake, indicating that during periods of active sleep children's memory traces of the animal's names were strengthened. The new memories the children had made of the non-words improved following periods of sleep irrespective of whether the training had happened in the morning or in the evening. Contrary to expectations, despite the challenges that children with ASD experience during sleep, the positive effects of sleep remained. New memories were not merely protected and strengthened, but were also maintained after a period of 24 hours. Sleep-dependent memory consolidation was possible for children with ASD, regardless of whether the training had occurred in the morning or evening. Significant differences in Sleep Duration, Night Wakings were found between the groups. Moreover, ASD children had higher CSHQ total scores than TD children. Children with ASD had significantly higher sleep onset delay and decreased sleep.
Conclusions: The findings suggest that sleep, does in fact play an active role in children with ASD, despite the reported sleep problems which are suggested to characterize them. Due to the scarcity of previous research on the area, the findings of the study emphasize the importance of sleep in children with ASD and stress its role in the process of learning. It is concluded, that sleep had a strengthening and stabilizing effect on the memories of both TD and children with ASD.
Gaining better understanding of the influence of sleep on children with ASD is important for the creation of teaching interventions. Such understandings will aid children's learning and development. It is therefore essential that teachers, educators and researchers focus on transmitting to parents and children the prominent role of sleep.

98 **161.098** Stratifying Working Memory Ability in ASD

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Background: Working memory (WM) refers to the short-term storage and manipulation of sensory information. The system is involved in a range of behaviours, from perception to higher level cognition and impairments have been reported in several neurodevelopmental and neuropsychiatric conditions. Some studies found WM impairments in autism spectrum disorder (ASD) relative to typically developing (TD) controls while others failed to find group differences. These discrepancies may be due to variability in performance among individuals with ASD. Furthermore, mean group differences alone do not enable inferences on individual performances. Therefore, we need to better understand the frequency and severity of WM deficits in ASD, and the impact of WM on symptom severity or adaptive functioning.
Objectives: (1) To identify case-control differences between ASD and control participants in a diverse sample, ranging in IQ between 50-120, and 6-30 years of age. (2) To stratify the ASD group by whether, and how far, each individual diverges from their age expected performance. (3) To link WM ability with autism symptomatology (social responsiveness SRS-2, repetitive behaviour RBS-R) and adaptive behaviour (Vineland).
Methods: From 6 research centres in 4 European countries, 390 individuals with ASD and 293 individuals with typical development (or mild intellectual disability) were tested on a visual-spatial WM task. The task required participants to remember the location of 4, 6, or 8 telephones in a visual array. The dependent measure was between-trial errors: the number of times a participant re-selected a target phone from a previous trial. We classified the WM skills of ASD individuals using Gaussian process modelling (GPM) by first estimating WM ability across age for TD individuals. We derived the extent to which individuals with ASD deviated from the estimated TD mean (within 1 SD, 1-2SDs, or >2SDs of the estimated mean for their age).
Results: Case control analysis demonstrated overall higher between-participant errors in the ASD group, across the 4 (p<.001, d: 0.294), 6 (p<.001, d: 0.388), and 8 (p<.001, d: 0.422) conditions. However, when the sample was split by age groups, this effect was only significant for adolescents and adults. Individuals with mild intellectual disability performed similarly regardless of an ASD diagnosis. We then carried forward the load 8 condition as a discrimination tool for GPM stratification. Despite the significant between group differences, 62.82%, of the ASD sample performed within +/-1 SD of the TD range. Only 19.50% of the ASD cohort performed <1SD and 11.54% performed <2SD of the age-related means. WM performance correlated with symptom severity, SRS-2 (r= .34), RBS-R (r = .22) and adaptive functioning (r = -.27) (all ps <.01).
Conclusions: Across a large sample, we demonstrate that case control differences varied with age, with significant group differences for the adolescents and adults only. Despite this, stratification analysis demonstrated that the majority of cases fell within 1SD. These relatively small impairments may have greater clinical significance if they co-occur with difficulties in other areas. The small percentage who had WM impairments in a clinically significant range, might indicate a sub-group suitable for treatment targets.

99 **161.099** Susceptibility to Optical Illusions in Autism Spectrum Disorder Depends on Illusion Characteristics

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Background: Chouinard et al (JADD, 2016) examined susceptibility to 13 optical illusions as a function of AQ traits in the general population. They demonstrated how one group of illusions with strong within-object relational properties (consisting of the Shepard's tabletops and square-diamond illusions) was associated with reduced susceptibility as a function of AQ whilst a different group of illusions with strong between-object relational properties (consisting of the Ebbinghaus and Delboeuf illusions) was not. From these results, the authors speculated that susceptibility to the former but not the latter group of illusions might also be reduced in ASD.
Objectives: Examine whether participants with a clinical diagnosis of ASD show reduced susceptibility to illusions with within-object relational properties, while simultaneously showing typical levels of susceptibility on illusions with between-object relational properties.
Methods: Â The participants included 15 children with ASD (11 males, mean age = 12.17 yrs, age range = 7.92 to 15.5 yrs) and 15 age and Performance IQ matched typically developing children (11 males, mean age = 12.21 yrs, age range = 8.45 to 14.7 yrs). The participants completed four trials of each illusion, in pseudorandom order (Shepard's tabletops, Square-Diamond, Ebbinghaus, Delboeuf illusions). Presentation was computerized, with participants adjusting one stimulus to match another. Eye-tracking was used to measure scan patterns while participants completed the task. To allow meaningful comparisons between illusions, we computed normalised indices of susceptibility for each illusion as: ((Perceived Size of Stimulus B - Perceived Size of Stimulus A) / (Perceived Size in Stimulus A + Perceived Size of Stimulus B)); B denoting the stimulus one would expect to see greater judgements in perceived size. Participants also completed control tasks to measure basic abilities in visual acuity and discrimination.
Results: The children with ASD (*M* = .14, *SD* = .10) were less susceptible to the Shepard's tabletops illusion than the typically developing children (*M* = .21, *SD* = .05), *t* (28) = 2.41, *p* = .023. There were no differences between groups on the other illusions.Â There were no differences between groups on any eye-tracking measures (saccade time, saccade distance, average saccade velocity, average saccade count, average pupil size, average block duration, time spent fixating).
Conclusions: We conclude that reduced illusory susceptibility in ASD is confined to certain groups of illusions, particularly those with strong within-object relational properties. We did not find any evidence to suggest that these differences could be driven by eye scan patterns.

100 **161.100** The Contribution of Visual Attention to Performance on Tests of Nonverbal Ability in Adolescents with Intellectual Disability with and without Comorbid Autism Spectrum Disorder

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Background: Â Few studies have considered how visual attention contributes to solving the visual items on nonverbal IQ tests especially for individuals with Intellectual Disability (ID) with and without Autism Spectrum Disorder (ASD) where fast activation and maintenance of visual attention is characteristically problematic.
Objectives: Â To identify the contribution of rapid activation of visual attention to the nonverbal IQ tests scores of adolescents with ID and typically developing (TD) children of comparable mental age.
Methods: Â We compared the performance of both groups on the Raven's Coloured Progressive Matrices, the Test of Nonverbal Intelligence –Fourth Edition and the Wechsler Nonverbal Scale of Ability, nonverbal IQ (NVIQ) test and threshold performance on 4 visual tasks requiring rapid and maintained activation of attention i.e., motion coherence, inspection time (IT), contrast threshold for illusory figures, and change detection. Multiple regression analyses were utilized to compare the contribution of the 4 visual attention tests scores to variance on NVIQ scores. Furthermore, as it is well accepted that many adolescents with ID also show co-morbid symptoms of Autism Spectrum Disorder (ID+ASD), we compared the performance on all tasks of the individuals with ID non-ASD and those with ID+ASD.
Results: Performance of the ID group was worse than that of the TD group on all visual attention tasks especially the IT task, which contributed significant variance to nonverbal tests scores for the ID group but not for the TD group. Threshold visual attention scores also contributed substantial amounts of variance to NVIQ test scores for the ID+ASD but not for the ID non-ASD group.
Conclusions: Our results suggest that adolescents with ID are slower to activate visual attention and complete visual NVIQ test items than children with TD of a similar mental age. The finding that the ID+ASD performed less well than the ID non-ASD confirms earlier observations that attention deficits are greatest for those with more severe ID and co-morbid ASD.

101 **161.101** The Impact of Lures on Semantic and Visuospatial Analogical Reasoning in Autistic Children

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Background: Â In some fluid reasoning studies, children complete analogies like ''Hive is to bee as aquarium is to?'' by selecting the appropriate answer between response options. These can include a lure: an answer related to one item of the analogy, but which doesn't correctly complete it. Younger typically developing (TD) children have poorer performance than the older ones in analogies containing lures, reflecting their poorer inhibition skills and ability to manipulate multiple relations (Richland et al., 2006). Only Green and colleagues (2016) studied the effects of lures in analogical reasoning in autism spectrum disorder (ASD). They did so using a social analogical reasoning task and found that young and old autistic and TD children's performances were similarly impacted by lures. Autistic children were found as good as TD children to solve pictured analogical problems of visuospatial and semantic content (Morsanyi & Holyoak, 2010), but the effects of lures in analogies varying exclusively in content has not been studied in ASD.
Objectives: Â To investigate how young and old autistic and TD children are affected by the presence of lures in semantic and visuospatial analogical reasoning problems.
Methods: Â 37 autistic and 42 TD children matched on age (6-13 years; *M*=9.54, *SD*=1.95) and on Raven's Progressive Matrices (*M*=57.57 percentile, *SD*=24.50) completed 80 pictured analogical reasoning problems on a computerized task. Problems varied in content (semantic vs visuospatial) and consisted of 2x2 matrices with last entry to be filled with one of the three responses options presented. 20/40 semantic and 13/40 visuospatial analogies contained a lure in their answer choices. For the semantic problems, lures were semantically related to one item from the matrix, while for the visuospatial problems, lures were visually identical to one item from the matrix. Mixed ANOVAs with Content and Lure presence as within-subject factors and Group and Age (6-9, 10-13 years) as between-subject factors were conducted for accuracy and reaction time (RT).
Results: For both autistic and TD children, visuospatial content and younger age of the participants decreased accuracy and increased RT. In all children, lure presence decreased accuracy, but did not increase RT. Moreover, for the analogies containing a lure, performance was significantly higher for semantic problems (*M*=75.19, *SD*=17.09) than for visuospatial problems (*M*=65.24, *SD*=24.4) ($p<.05$), and older children (*M*=76.76, *SD*=16.30) were more accurate than the younger ones (*M*=61.10, *SD*=18.52) ($p<.05$). Interestingly, even though no significant difference in accuracy between autistic and TD children was found for any condition of the task, autistic children (*M*=5403.32, *SD*=2198.41) were faster than TD children (*M*=6775.07, *SD*=1960.45) to correctly solve visuospatial analogies with and without a lure ($p<.05$).
Conclusions: Autistic and TD school-age children are similarly affected by the presence of lure during semantic and visuospatial analogical reasoning, bringing further support to intact fluid reasoning skills and development in ASD. Also, the observed faster reaction time of autistic children relative to TD children for solving visuospatial analogies suggests superior visuospatial reasoning skills in autistic children, independently of the presence of a lure.

102 **161.102** The Relation Between Visual Disengagement and Autistic Traits: An Eye-Tracking Study of 410 Individuals

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Background: Â Attentional atypicalities are often found in individuals with ASD, and problems with reallocating attention have been proposed as a plausible explanation for the cognitive and social deficits characterizing the autism phenotype. Using the visual disengagement paradigm, where the task is to move one's gaze away from a central stimulus (CS) when a new stimulus appears in the periphery, several studies suggest that flexibility in visual orienting is impaired in adults and children with autism, as well as infants with a later diagnosis of ASD.Â ASD is commonly conceived as the extreme end of a phenotypic and etiological continuum. Yet, how visual disengagement relates to autistic traits in the typical population remains unknown. Furthermore, case-control differences have not always been replicated when visual disengagement is assessed in childhood (i.e., beyond infancy).
Objectives: Â To test the hypothesis that slower visual disengagement is related to higher ASD traits in a typical population sample of children.
Methods: The final sample consisted of 410 twins ranging age from 9-14 years recruited from the Child and Adolescent Twin Study in Sweden (CATSS). All twins were included in the analysis below, but all effects remained in a control analysis where one twin from each twin pair was removed. Twin modeling analysis is not reported at this point, but is an upcoming step of the analysis. ASD traits were assessed using the Social Responsiveness Scale (SRS). Visual disengagement was measured using the prosaccade (gap-overlap) paradigm on a Tobii T120 eye tracker. In the current analysis, our dependent measure, the disengagement effect, was defined as the difference in saccadic reaction times between the overlap (CS remained) and the baseline conditions (CS disappeared when peripheral stimuli appeared). Additionally, the relation between SRS and absolute performance in the aforementioned conditions as well as a third, the gap (CS disappears 200ms before the peripheral appears) is analyzed.
Results: We found the expected effect of condition on saccadic reaction times: gap (*M*=200.2ms, *SD*= 56.9ms), baseline (*M*=235.4ms, *SD*= 60ms), overlap (*M*=261.9ms, *SD*= 75.4ms; all pairwise comparisons p<.001). We found no indication that the disengagement effect was related to severity scores on the SRS (r = .01, p>.25). However, higher ASD traits were associated with slower visual orienting in all conditions (Gap: r = .178, p=.001; Baseline: r = .171, p<.001; Overlap: r = .140, p=.004). Neither age nor number of valid trials were related to the disengagement effect.
Conclusions: These data indicate that visual disengagement (as typically operationalized in the literature, e.g. Elsabbagh et al 2013) is not related to the level of autistic traits in typically developing children of 9-14 years. Rather, the correlations with absolute latencies (in all conditions) could suggest that higher autistic traits are associated with slower reactive eye movements. With the reservation that this was a study of traits and not a case-control study, these data from several hundreds of individuals do not support that visual disengagement is related to autism in late childhood.

103 **161.103** Too Little Strategy, Too Much Guessing: Problem-Solving in High-Functioning Adolescents with ASD

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Background: Twenty Questions is a game that requires the player to select a target object from an array using information gathered by asking only twenty or fewer yes/no questions. It allows the exploration of problem-solving abilities in a highly-motivating context. Successful performance requires concept formation (grouping by abstract concepts, such as "living things"), verbal abilities (asking a question), strategy (asking questions in an efficient order), verbal working memory (remembering answers), and inhibition (not guessing until obtaining enough information). Previous research has shown that individuals with ASD generate less efficient questions (despite unimpaired recognition of efficient questions), make more premature guesses, and correctly identify fewer items than their typically-developing peers. Manipulations of the task have revealed that their poor performance is likely not due to attention or working memory problems.
Objectives: First, we sought to replicate the performance findings of previous research. Second, while previous research manipulated the task to explore factors theorized to underlie poor performance, we utilized parent-report and neuropsychological measures to explore such factors, namely concept formation ability, VIQ, inattention, impulsivity, and verbal working memory. Finally, we sought to investigate relationships between task performance and autism symptomatology as no relationships have previously been reported.
Methods: The sample consisted of 26 high-functioning (FIQ > 80) adolescents with ASD and 27 age (*M* 14.8 years)- and VIQ (*M* 102.7)-matched typically-developing controls. We used the Delis-Kaplan Executive Function System (D-KEFS) Twenty Questions task. Concept formation, VIQ, attention problems, impulsivity, and verbal working memory were measured using the D-KEFS Card Sorting task, WASI-II, Conners Parent Rating Scale, and WRAML-2 respectively. One-way ANOVAs explored group differences on task performance variables. Two-tailed Pearson correlations explored relationships between task performance, the factors listed, and autism symptomatology measured using the SRS-2.
Results: Consistent with previous findings, our ASD sample identified fewer items (F[1,51] = 6.34, p = .02, η^2 = .11) and were less efficient in their questioning (F[1,51] =4.51, p = .04, η^2 = .08) than their typically-developing peers. In contrast to previous findings, our sample was not less efficient in their questioning when questions that did not constitute a guess were excluded (F[1,51] =.24, p = .63). Successfully identifying items and question efficiency were associated with concept formation ability (r = .41, p = .04; r = .47, p=.02) and VIQ (r = .56, p = .003; r = .57, p = .002), while only identification success was associated with verbal working memory (r = .56, p=.003). There were no significant associations between task performance variables and inattention, impulsivity, or autism symptomatology.
Conclusions: We confirm past findings of impaired performance on Twenty Questions in ASD and significant associations between performance and concept formation ability, VIQ, and verbal working memory. Our new finding of impaired performance despite unimpaired *generation* of efficient questions (after removing guesses) reinforces a previous finding of impaired performance despite unimpaired *recognition* of efficient questions. Together, these findings point to a strategy deficit. The lack of association between performance and autism symptomatology weakens the theoretical significance of concept formation deficits in ASD.

104 **161.104** Untapped Mathematical Learning Capacity in Children with Autism Spectrum Disorders

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Background:
While mathematics is often cited as an area of preserved abilities for individuals with autism spectrum disorders (ASD), emerging research suggests this domain is not a universal strength for children on the spectrum. However, a child's current math achievement reflects, in part, their educational history and thus may not capture their full learning potential. Assessing mathematical learning in children of varying achievement levels has the potential to inform the design of educational interventions and impact employment opportunities for individuals with ASD.
Objectives:
We sought to investigate learning trajectories in an arithmetic training task in children with ASD and relate them to standardized measures of mathematical achievement. We then assess whether children with ASD show the same relationship between learning rates and math ability as their typically developing (TD) peers.
Methods:
21 children with autism ages 8-11 and 19 age- and IQ- matched TD children participated in a five session one-on-one math training program focused on memorizing 14 double- plus single-digit arithmetic problems (47+9=56). Each session involved 14 exposures to each problem in a variety of physical and computerized settings. In a physical flash card task, children completed three rounds, where they verbally solved all 14 training problems, twice. After the first round, children were encouraged to "beat their time" on two subsequent rounds. To identify distinct learning profiles within each group, we performed a latent class growth modeling (LCGM) analysis using the average daily performance of each participant. Mathematical skills were assessed prior to training using the Broad Math composite of Woodcock Johnson Tests of Achievement- III.
Results:
In the ASD group LCGM identified three classes: two with slow initial starting reaction times (11.7 vs. 10.6 sec per problem), and a third, much faster class (3.9 sec). Between the two initially slow groups, one had a much faster learning rate (-1.6 vs. -1.2). Notably, this group had poorer math skills (87 on Broad Math) than the slower learning group (103). This pattern of larger learning gains for lower math skills was also captured by a significant correlation between math achievement and learning slope in the ASD group as a whole (r =.62, p=.003). In the TD group, LCGM also identified three classes, but they had more similar initial performance (4.4, 6.4, 6.0) and learning rates (-.4, -.9, -.6), and notably learning rates did not correlate with math ability (r=.43, p>.05).
Conclusions:
Emerging research suggests that math skills are not a universal strength in children with ASD. However, it remains to be determined if children with poorer math achievement could excel if presented with more optimal learning environments. In the current study we used one-on-one training, and a variety of activities to engage children in a math fact learning task. While all children improved on the task, only among children with ASD did we find larger learning gains for children with the lowest achievement levels. Together, these results suggest that children with ASD who struggle in math may have untapped mathematical learning potential.

105 **161.105** Using a 3-D Multiple Object Tracking (MOT) Task to Assess Attentional Abilities in Autism

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Background: Autism spectrum disorder (ASD) is characterized by differences in visuo-spatial perceptual and attentional abilities. Multiple object tracking (MOT) paradigms are useful in assessing both these abilities, as this task demands the use of sustained, selective, and distributed attention to dynamic visual information. Outcomes of previous MOT studies in ASD have been interpreted within either perceptual (e.g., van de Hallen, 2015) or attentional (e.g., Koldewyn et al., 2013) contexts. As suggested by the Flexible Resource Model (Alvarez and Franconeri, 2007), attentional capacity is increasingly taxed during MOT as the number of target items (i.e., load) of the task increases. We used a 3D-MOT task to manipulate load in an effort to assess dynamic visual attention in individuals on the autism spectrum. We also assessed whether typically beneficial trial-by-trial feedback differentially affected performance.
Objectives: (1) To assess the effect of cognitive load on 3D-MOT performance in individuals on the autism spectrum. (2) To investigate whether performance differs (a) at different levels of cognitive loading, and (b) with or without feedback.
Methods: Individuals on the autism spectrum of average intelligence (n=16; M_{age}=21.82 years; M_{FSIQ}=105.65) and neurotypicals (n=40; M_{age} =23.93 years; M_{FSIQ}=104.75) tracked two blocks of 1, 2, 3, & 4 target items (spheres) among 8 in 3-D virtual space using a wearable head-mounted display. Half were shown the correct answers for each trial (Feedback groups), and half were not (No Feedback groups). Performance was defined as the average speed at which participants could successfully track all target spheres (Speed Threshold) at each load level (1, 2, 3, & 4 target items).
Results: ANOVAs revealed significant differences across all levels of Load (# tracked items) for both the ASD (p < .001) and TD (p < .001) groups; collapsed across feedback condition. No load by feedback group interaction was found for either diagnostic group. Analyses also revealed no interaction effects between diagnostic and feedback groups and load levels. However, when collapsing across load levels, a significant effect of diagnostic group was found (p=0.008); with the TD group outperforming the ASD group. Feedback significantly hindered performance in the TD group when speed threshold was collapsed across load p=0.010). When comparing performance between the first and second test block (collapsed across load level), improved performance on the second block was found only for the ASD Feedback group (p=0.020).
Conclusions: Results support the use of our 3D-MOT task to target attentional abilities in ASD; as all groups demonstrated a decrease in performance as the number of tracked target items increased. Though a significantly lower overall average 3D-MOT performance was found in the ASD groups, we are not, at present, proposing that this difference is due to a differential ability to flexibly allocate attention across target items in ASD. The feedback-enhanced performance across test blocks does suggest that feedback may be important to consider in the study of attention in ASD. Our findings will be discussed within the context of current theories of the role of attention in perceptual abilities in ASD (e.g., Remington et al., 2009).

106 **161.106** Visual Detection and Decoding of Aerial Photographs in Adults with ASD

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Background: People with High Functioning Autism Spectrum Disorder (HFASD) typically face difficulties in employment. One potential approach to this problem is to take advantage of their known strengths, such as the often observed enhanced perception of details and superior visual search. In the current study we investigated these potential strengths in a battery of real-worlds tasks of decryption of aerial and satellite photographs.
Objectives: Study visual detection and decoding skills for details embedded in aerial photographs in adults with HFASD compared to matched controls. Investigate the different components involved in these real-life skills by additional tests, including the classical visual-search, embedded figures and vigilance.
Methods: 40 young male adults (17-21 years), 20 with HFASD and 20 typically developed (control), participated in the experiments. The groups had comparable scores on the Raven Matrix test for intellectual abilities. They were tested in three one-hour sessions on a battery of visual tests. Five tests on aerial-photographs detection and decoding included: (1) "stamp detection", where observers had to locate a small patch (stamp) in a large image; (2) "change detection", where observers had to mark the change between two images presented side by side; (3) " identification by legend", where observers had to use a 6-vehicle legend to identify highly degraded photographs of the vehicles embedded in a terrain; (4) A similar "vehicle Identification", such as a truck, private car, and bus; (5) "contrast threshold", where observer had to detect and mark multiple low contrast natural objects (e.g. deer) embedded in a photograph. Additional tests included: (a) Visual Search, with the classical feature (color, shape) and conjunction search tasks; (b) Embedded Figure Test (EFT) with 12 complex figures; (c) Vigilance Test, where observers viewed a constantly changing display of multiple letters in color and had to search for one of 3 target letters.
Results: Overall, no significant differences between groups were found in most tests, including visual search. The HFASD group had a small significant advantage in the EFT and the “stamp detection” test, but a small disadvantage in the "identification by legend" and "vehicle identification" tests, as well as in the vigilance test.Â Correlation analysis between tests across observers showed that the Raven matrix test was significantly correlated with all other tests, while the Vigilance Test was correlated with most tests in the control but not HFASD group. Additional correlations were found between the visual search slopes and the EFT and "identification by legend" response times, but these effects differed between groups.
Conclusions: Contrary to expectations, no significant superiority of the HFASD was found, including in conjunction search. The conjunction search slopes in the HFASD group were very similar to previous studies, while our control group performed better than previously reported. The fact that the vast majority of our control group members were "video gamers" (>5 weekly hours of play) could explain some superior performance. Overall, the results indicate performance as good as controls by the HFASD participants and a potential successful employment in work related to decryption of aerial and satellite photographs.

107 **161.107** Visual Illusion Susceptibility in Children with Autism Spectrum Disorder: Local Versus Global Processing

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Background: Research by Happè (1996) showed that individuals with ASD demonstrated less susceptibility to visual illusions, which may suggest enhanced local processing abilities. However, subsequent studies have produced mixed results, and there is also debate as to whether superior local processing corresponds to difficulties in processing visual illusions at the gestalt level.
Objectives: The present study aimed to reconcile the discrepancy in results across studies by conducting a replication of Happè’s design and extending the measurement precision of previous research through the use of eye tracking instrumentation. Eye gaze data may help to reconcile contradictory findings by determining whether all children in the present sample demonstrate a local processing bias, and whether this local processing bias is the mechanism responsible for decreased illusion susceptibility.
Methods: Participants were 36 children (17 with ASD, 19 typically developing) ages 4-13 years matched on chronological age. Local global processing was measured using a visual illusion task conducted with eye tracking technology, as well as an existing measure of central coherence.
Results: In contrast to Happe (1996), analyses revealed no overall group differences in illusion susceptibility, but eye gaze data revealed that children with ASD attend to different areas of the visual scene depending on individual variability in illusion susceptibility.
Conclusions: These findings augment recent research on the nature of visual processing in ASD, specifically suggesting a local bias for some children with ASD rather than an overall deficit in the ability to process global information inherent to all ASD cases. For a subset of children with ASD that do demonstrate evidence of a local processing bias, this in part contributes to decreased susceptibility to visual illusions.

108 **161.108** Visual Working Memory and Filtering Ability in Individuals with Autism Spectrum Disorder

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Background: Past investigations have reported impaired working memory performance in individuals with Autism Spectrum Disorder (ASD) (Geurts, de Vris, & van den Bergh, 2014). It remains unclear, however, to what extent the previously observed performance differences reflect a decreased memory capacity, difficulties with preventing irrelevant information from filling capacity (i.e., filtering ability), and/or disruption in focused attention.
Objectives: The current study assessed the contribution of core processes (e.g. working memory capacity, attention, and visual filtering abilities) to visual working memory performance in adolescents and adults with and without ASD.
Methods: Data from 48 subjects (24 with ASD; 24 without ASD) between 16 and 24 years old were analyzed. Estimated Full Scale IQ for all subjects was >80. Participants completed a computerized paradigm designed to systematically assess capacity, attention, and visual filtering abilities during visual working memory performance (Cowan et al., 2011; Mall et al., 2014). Subjects were shown visual arrays consisting of 2, 3, 4, 6, or 8 colored stimuli (circles and/or squares). After a short delay, memory for the color of one of the stimuli was probed (same or different color). Importantly, subjects were informed beforehand that the one of the shapes (e.g., circles; high frequency probes) was more likely to be probed compared to the other shape (e.g., squares; low frequency probes), allowing them to allocate their attention and filtering accordingly. Three different blocks of trials were presented: [1] trials with only one shape (100% high frequency probes), [2] trials with both shapes but only one shape probed (100% high frequency probes), and [3] trials with both shapes and both shapes probed (75% high frequency and 25% low frequency probes). Eye tracking data was simultaneously collected.
Results: Results revealed comparable estimates of overall working memory capacity between groups (maximum mean capacity: ASD = 3.81 and non-ASD = 3.84), $F(1,46) < 1$, $p = 0.44$, $h_P^2 = 0.01$. However, performance for individuals with ASD was more impacted by increases in attention and visual filtering demands than individuals without ASD. Individuals with ASD also allocated their attention differently than non-ASD individuals and spent less time looking at relevant information, especially as the task increased in complexity (e.g., 25% versus 38% of time looking at relevant information for 8 stimuli), $F(1,46) = 4.11$, $p = 0.01$, $h_P^2 = 0.08$. The ASD group had more difficulty filtering distracting information in the most challenging condition (8 stimuli, high/low frequency), $t(46) = 2.19$, $p = 0.03$, Cohen’s $d = 0.63$. Specifically, individuals with ASD were less effective at allocating working memory capacity to the high versus low frequency stimuli in comparison to individuals without ASD.
Conclusions: Â Findings suggest that visual working memory performance is similar between individuals with and without ASD when cognitive demands are low, but individuals with ASD are detrimentally affected when the cognitive load increases (increased attention and visual filtering demands). Given the complexity of our environments and need to filter visually distracting information, these findings may shed light on ASD-related difficulties in day-to-day functioning and provide a focus for intervention.

109 **161.109** 'Sticky' Attention in Children and Youth with Autism Spectrum Disorder: General Deficit or Task Dependent?

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Background: Individuals with autism spectrum disorder (ASD) have difficulty disengaging and shifting their attention or what has been termed 'sticky' attention. This 'sticky' attention has been hypothesized as a general deficit of the broader ASD phenotype, and can aid in early identification. Researchers to date have only examined endogenous and exogenous attention abilities, or when the cue to shift and disengage attention is externally provided. However, in everyday attention situations, decisions to disengage or shift are often generated internally, in the absence of external cues, such as when scanning a scene. This self-generated, "autogenous attention," is a focus of the present study. Due to the implications of attention on later social and language development, a richer understanding of attention abilities in individuals with ASD is critical.
Objectives: Â The primary objective was to evaluate whether disengagement and shifting abilities in children and adolescents with ASD are characterized by a general deficit. We did this by evaluating two different types of attention, exogenous and autogenous attention. How task stimuli impact attention was also studied, that is, whether the type of task, the content of stimuli, and the level of complexity of the stimuli impact participants' attention abilities. Lastly, we explored how specific demographic characteristics and clinical variables, including cognitive level, were related to attention abilities of children with ASD and typically developing (TD) children.
Methods: Â Two groups of children, ages 6 - 15 years, participated in the present study. The current samples included 20 TD children and 18 children with a diagnosis of ASD. The TD children were group-matched to children with ASD based on their chronological age and intellectual ability. The participants' attention abilities were measured using a novel eye-tracking attention task, that determined autogenous and exogenous attention abilities. Task stimuli varied based on complexity (modality of the information, motion of the stimulus), and the degree of synchrony in the stimulus. Demographic and clinical variables were measured using a formal cognitive assessment and parent-report measures.
Results: Findings from multi-level modeling analyses indicate that participants with ASD took longer time to fixate, and had fewer fixations than TD children, suggesting that 'sticky' attention characterizes this population, but only in certain circumstances. In other conditions there was no evidence to support 'stickiness'. A number of task-specific variables (e.g., attention type, trial type, stimuli type, and stimuli motion and synchrony) and participant-specific variables (chronological age and verbal cognitive ability) predicted performance on the attention task in both groups.
Conclusions: Overall, findings from the present study do not support previous research indicating inferior disengaging and shifting abilities in children with ASD, as attention abilities varied based on attention type and other task-dependent variables, including task stimuli. Thus, the current findings do not provide clear support for the hypothesis that 'sticky' attention is a general deficit in children with ASD. As a result, its potential as a diagnostic marker is questionable, or, at best, limited to very specific stimulus parameters.

Poster Session
162 - Interventions - Pharmacologic
5:00 PM - 6:30 PM - Golden Gate Ballroom

110 **162.110** A Pilot Dose Finding Study of Pioglitazone in Children with ASD

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Background:
Only two medications have approval for use in autism spectrum disorder (ASD), (risperidone and aripiprazole) and they treat irritability and aggression. However, there are no pharmaceutical treatment options for the core symptoms of autism. Importantly, we have not been able to impact the developmental trajectory of children with ASD, likely because we are not targeting the underlining pathophysiology. Pioglitazone is a promising compound that targets multiple pathways implicated in ASD such as immune dysregulation, oxidative stress, mitochondrial dysfunction, and NMDA inhibition.
Objectives:
The objective of this pilot study of pioglitazone was to elucidate the maximum tolerated dose and safety, provide early data supporting efficacy, and identify appropriate measures sensitive to change in children with ASD ages 5-12 years old. We hypothesized that pioglitazone would be well tolerated at the maximum dose of 0.75mg/kg once daily.
Methods:
We conducted a 16-week prospective cohort, single blind, 2-week placebo run-in dose-finding clinical trial between June 2013 and September 2015. Interested potential participants (131) were phone screened, 35 consented, 28 participants initiated treatment, and 25 completed treatment. A modified dose finding method was used to determine safety and dose response among three dose levels: 0.25mg/kg, 0.5mg/kg, and 0.75mg/kg once daily. Classical dose-finding escalations were done in groups of five participants, with five participants studied at the first dose level (0.25mg/kg once daily), five participants were studied at the second dose level (0.5mg/kg once daily), and the final 18 participants were studied at the maximum dose level (0.75mg/kg once daily).
Results:
Maximum tolerated dose: There were no serious adverse events (SAEs) and as such the maximum tolerated dose within the range tested was determined to be 0.75mg/kg once daily.
Safety: Overall, pioglitazone was well tolerated. Two participants discontinued intervention due to perceived non-efficacy and one due to the inability to tolerate interim blood work during the study. Adverse events (AEs) were of mild to moderate severity. Three participants experienced mild neutropenia. In one participant this was a pre-existing condition, in another it resolved while staying on medication and in the third it only presented during the final visit and spontaneously recovered. As such, it was deemed to be unrelated to the study intervention.
Early evidence of efficacy: One participant was a responder after 2 weeks of placebo and was removed from the analysis. Regression analyses showed statistically significant improvements within group for social withdrawal and repetitive behaviors, as well as externalizing behaviors as measured by the Aberrant Behavior Checklist (ABC) and Repetitive Behavior Scale –Revised (RBS-R), and after multiple comparisons correction, but not in anxiety or social responsiveness. Forty-six percent of those enrolled were deemed to be global responders. Of particular interest, high pro-inflammatory cytokine levels at baseline as well as changes during the study were correlated with treatment response.
Conclusions:
Pioglitazone is well-tolerated and shows a potential signal in measures of social withdrawal, repetitive behaviors, and externalizing behaviors. High levels of pro-inflammatory cytokines at baseline are associated with treatment response. Randomized controlled trials using the confirmed dose are warranted.

111 **162.111** Changes in Sleep Habits during Drug Treatment of ASD

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Background: Children with Autism Spectrum Disorder(ASD) are at high risk for two major family stressors: sleep disorders and problem behaviors, including irritability. A NICHD funded biomarker study of aripiprazole versus risperidone with a primary focus of treating irritability in children with autism also evaluated sleep pre and post treatment for irritability.
Objectives: (1) Using the Children's Sleep Habits Questionnaire(CSHQ), was there a difference between the number of African Americans(AA) versus the number of Caucasians(C) with no sleep problems? (2) Did children with an IQ<70 have similar sleep scores as children with an IQ≥70? (3) Was there a difference between AA and C in IQ? (4) Did children with sleep problems differ on Aberrant Behavior Checklist(ABC) subscales from children with no sleep problems? (5) Was there a medication effect on pre versus post treatment CSHQ total scores? (6) Was there a treatment effect on sleep latency and night time awakening?
Methods: Inclusion criteria for this double-blind, placebo controlled study were children aged 6-17 with an ASD diagnosis, an ABC irritability score ≥18, and not currently taking or previously treated with aripiprazole or risperidone. Screening included developmental and medical history, the Vineland Adaptive Behavior Scale, the Autism Diagnostic Observation Schedule, the Autism Diagnostic Interview-Revised and the Stanford-Binet-5 IQ Test. Parents of children screen positive for ASD completed the CSHQS and the ABC before children were randomized to drug treatment and at study completion.
Results: This preliminary study included 45 children, 60% C and 40%AA. There was no difference in the number of AA versus C with a sleep score <41. Mean pre-post study sleep scores of AA children did not differ from those of C children. Sleep scores for children with an IQ<70 versus those with IQ≥70 were not statistically different. There was no difference between the mean IQ of C and AA children. By ANOVA, the ABC Lethargy, Stereotypy, Hyperactivity and Inappropriate Speech subscale scores did not differ between children with sleep versus no sleep problems. A difference in the Irritability subscale score in sleep versus no sleep problems approached significance (F=3.34, p=0.07). For the total sample of children on aripiprazole or risperidone, the pre-drug sleep score was significantly worse than the post-drug score, t(44)=5.01, p<0.00l). CSHQ total mean scores of children on aripiprazole(n=23) versus risperidone(n=22) were compared. Risperidone performed significantly better than aripiprazole in addressing sleep disturbance, t(31.11)=2.11, p<0.04). The two drugs did not differ in treatment of CSHQ sleep latency or night time awakening scores. Pre-drug sleep latency scores were significantly worse than post-drug scores, t(44)=-3.07, p<0.0036. There was a trend towards significance for decreased night-time awakening post treatment, t(44)=179, p<0.08.
Conclusions: In children with high irritability, problems with sleep versus no sleep problems approached significance. Sleep scores for children with IQ<70 versus those with IQ≥70 were not statistically different. Both medications significantly reduced CSHQ problems with sleep. Risperidone performed significantly better than aripiprazole overall. However, there was no difference between the two in improved outcome for sleep latency and a trend for decreased night-time awakening.

112 **162.112** Effectiveness of Propranolol for Treating Anxiety and Aggression in Children and Adolescents with Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) is a multifactorial disorder, and currently, there are no routinely prescribed medications that can improve core symptoms in patients with ASD (Santosh and Singh, 2016). The current clinical practice is to target the symptoms of co-occurring disorders associated with ASD such as hyperactivity, irritability, anxiety, psychosis, depression, aggression, and/or repetitive behaviour. Anxiety and aggression management is critical in optimising outcomes in at least 40-50% of children and adolescents with ASD. Anecdotal evidence has pointed towards the beneficial effects of the prototypical beta-blocker propranolol for managing the symptoms of anxiety and aggression in children and adolescents with ASD; however, further clinical effectiveness studies are warranted to explore this.
Objectives: To assess clinical effectiveness of propranolol in reducing anxiety and aggressive symptoms in children and adolescents with ASD
Methods: This service evaluation project was approved by the South London & Maudsley NHS Foundation Trust, UK. All children with ASD treated in the Centre for Interventional Paediatric Psychopharmacology and Rare Diseases (CIPPRD), a national specialist service in the United Kingdom that specializes in the psychopharmacological management of complex disorders and rare diseases were screened to identify patients being treated with propranolol. From 180 children within the clinic, 27 were diagnosed with ASD and were prescribed propranolol - 4 of these were discharged from the clinic, resulting in 23 eligible children aged between 8-19 years. Parents and clinicians in the CIPPRD routinely complete a series of web-based questionnaires using the HealthTracker™platform, in order to capture information on clinical effectiveness of treatments used in routine clinical care.
Results: The mean daily dose of propranolol was 44.67+/-22.31mg and mean duration of use was 24.00+/-12.71 months. The pre- and post-treatment measures on the Profile of Treatment Response (POTR) measuring symptoms and side-effects, Clinical Global Impression scales, and Therapeutic Efficacy Index revealed a significant reduction in 'anxiety,' 'aggression,' and 'explosive rage' with propranolol treatment. The main side-effect was increased appetite. The mean CGI-Improvement scores for propranolol treatment was 1.61+/-0.78 and the Efficacy Index was 3.16+/-1.05, suggesting very good efficacy. The results show that 'emotional, behavioural, and autonomic dysregulation' (EBAD), is an important aspect in difficult-to-manage ASD, which responds to treatment with propranolol.
Conclusions: This study provides further supportive evidence for the use of propranolol for managing the symptoms of anxiety and aggression in children and adolescents with ASD. It also shows that beta-blockers can be used when managing EBAD in ASD with previously poor treatment outcomes. Given the current findings, further exploration for the use of propranolol for anxiety and aggression symptoms in children and adolescents with ASD is warranted.

113 **162.113** Immune Response to Pregnenolone Treatment in Adults with Autism Spectrum Disorder – Preliminary Analysis from an Open-Label Study

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Background:
Pregnenolone (PREG) is the precursor of endogenous pharmacologically active neurosteroids. We recently reported the results of an open-label trial of PREG in the treatment of adults with autism spectrum disorder (ASD). We found that PREG reduced the levels of irritability and associated aggressive behaviors as measured by the Aberrant Behavior Checklist – Irritability subscale (ABC-I). PREG was also found to be well-tolerated by study participants. We hypothesize that responders of PREG will have a different immune biosignature, as compared to non-responders.
Objectives:
To explore the association between response to PREG and plasma concentrations of immune biomarkers before and after 12-week trial of oral PREG.
Methods:
PREG was initiated at 50mg twice daily in weeks 1 and 2, then increased by 50mg twice daily every 2 weeks to a final dose of 250mg twice daily which was maintained from weeks 9 to 12. Primary outcome measure was the ABC-I. Response was defined as change of ABC-I of 7 or greater. The plasma levels of 62 cytokines and other immune biomarkers were measured by Luminex Multiplex Analyses (LMA; at the Human Immune Monitoring Center at Stanford University) before and after PREG treatment in our open-label trial in adults with ASD. LMA is a simultaneous analysis of multiple analytes from the same sample using differentially dyed beads. Two-tailed student t-tests were performed to compare selected pro-inflammatory cytokines between responders and non-responders. Multivariate analyses, including decision tree analyses and elastic net regression, of the immune biomarker data before and after PREG treatment were performed.
Results:
Twelve individuals with ASD (mean age 22.5 years) participated in this open-label study. PREG yielded improvement in the primary measure, ABC-I [17.4±7.4 at baseline; 11.2±7.0 at 12 weeks (p=0.028)]. Six participants were found to be responders to PREG treatment, while the rest of the six participants did not reach the responder criteria. Preliminary decision tree analysis suggested that participants can be cleanly classified into responders and non-responders based on baseline levels of IL-31 and fibroblast growth factor β (FGFβ). Targeting the cytokines known to have increased levels in individuals with ASD (IL-1β, IL-6, IL-8, IFN-γ, eotaxin and MCP-1), the levels of the selected cytokines at baseline and post-treatment were statistically indistinguishable. In exploring the plasma levels of other immune biomarkers in the open-label PREG study, the responders were found to have significantly lower levels of plasminogen activator inhibitor 1 (PAI-1) post-treatment, compared to non-responders (p=0.042). Elastic-net regression did not yield meaningful results on either pre- or post-treatment LMA data.
Conclusions:
Preliminary LMA analysis found that specific immune biomarkers were associated with reduction of ABC-I. These findings suggest that effectiveness of PREG might be related to baseline levels of IL-31 and FGFβ. Additional research is needed to replicate these findings in a controlled trial.

114 **162.114** Improvement of Receptive Language but Behavioral Worsening with Combined Donepezil and Choline Treatment

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Background: Social communication impairment is a core feature of autism spectrum disorder (ASD) with no effective pharmacologic treatment. Donepezil treatment was evaluated as such and showed to have a minimal effect on language in children with autism.
Objectives: In order to enhance the effect of Acetyl Choline activity and inhibition, we added the substrate of Choline to Donepezil treatment in a double blind randomized study of 60 children and adolescents with Autism Spectrum Disorder. Efficacy, safety, and tolerability of oral Donepezil + Choline (D&C) combination were assessed.
Methods:
This study was a 9 months randomized, double-blind, placebo-controlled trial of 12 weeks incremental and add- on oral D&C in youth with ASD, preceded by 3 months baseline evaluation and followed by 6 months of wash- out, with subsequent follow up. Study participants were youth between the ages of 5-16 years with ASD, randomized to active drug or placebo in a 1:1 ratio, with the target dose Donepezil 5 mg + Choline as a crushed mixture. Donepezil was administered to the treatment group during the first 12 weeks (2.5 mg/day increased to 5 mg/day after 2 weeks). The Choline dietary supplementation (350mg) was added for the last 4 weeks**,** both crushed to powder by the pharmacy. Follow up was performed at three months and at nine months (after 6 months wash-out). Placebo powdered tablets were provided at in the same amounts and schedules as the control group. The primary outcome measure of efficacy was language measure. Secondary measures included adaptive functioning as measured by Vineland subscales, executive function measured by BRIEF, and social – behavioral skillsÂ measured using ATEC and CGI. Before removing the randomization, both examiner and parent reported his impression about group attendance (placebo vs. D&C). At nine months, the placebo group was notified and continued open- label D&C treatment by same protocol. The one arm crossover follow ups will be reported separately.
Results:
Sixty patients were enrolled (D&C = 29, placebo = 31, age 9.5 years + 3.1, 73% male and IQ 60 + 25). There were no significant differences at baseline between groups in all demographic and clinical variables. Six patients did not continue after initial evaluation due to compliance issues or urgent need for psychotropic medication, 6 did not complete the study (3 due to side effects), 48 completed treatment and 46 completed washout measurements. The frequency of adverse events was high (52%), with no significant difference between groups. However, there were significant differences in the type**s** of side effects with more sleep disturbance, GI side effects, headache and slightly more agitation in the treatment group. 62% of parents correctly guessed group belonging. The daily personal skills**,** as measured by Vineland subscale, and health/ physical behavior of the treatment group worsened significantly compared to placebo. After wash- out, all differences diminished except significant and persistent improvement in receptive language skills (p= 0.003).
Conclusions: Combined Donepezil- choline treatment may improve language skills in youth with ASD, however, temporary worsening of behavior is a significant side effect of this treatment.

115 **162.115** Metformin for Medication-Associated Weight Gain in Youth with Autism Spectrum Disorder

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Background:
Aggression, self-injurious behavior, and severe tantrums (referred to as “irritability”), are common targets of pharmacotherapy in youth with autism spectrum disorder (ASD). Placebo controlled trials have demonstrated the efficacy of risperidone and aripiprazole for treatment of ASD-associated irritability, resulting in FDA-approval of these medications. Unfortunately, antipsychotic treatment is associated with weight gain, changes in glucose and lipid metabolism, and poor cardiovascular outcomes, and youth with ASD may be at particular risk for these adverse effects. Emerging evidence suggests that metformin may have a role in treating medication-associated weight gain in youth with ASD.
Objectives:
In this study, we completed a retrospective chart review of youth with ASD treated with metformin targeting medication-associated weight gain with goal of deepening our understanding of the impact of this drug in our patient population.
Methods:
Via systematic review of electronic medical records, we identified 57 individuals with ASD age 2-20 years treated with metformin between July 2012 and February 2016. Demographic data, concomitant medications, metformin treatment duration, metformin dose, and BMI z-score at initiation and end of treatment were collected. Paired sample *t*-tests were used to evaluate change in BMI z-score with metformin treatment. A series of repeated ANOVA’s tested age, sex, duration of treatment, dose (initial and final) as possible moderators of BMI z-score change.
Results:
Participants were primarily male (81%), Caucasian (88%), and suffered from cognitive impairment (67%) and a disruptive behavior disorder (95%). Mean age was 13.6 (SD=2.7) years, mean duration of treatment with metformin was 1.96 (SD=1.7) years. Metformin doses ranged from 250 mg to 2000 mg, with mean starting dose of 772 mg (SD=361) and mean final dose 1173 mg (SD=536 mg). Ninety-one percent of participants received concomitant treatment with an antipsychotic throughout duration of metformin treatment, and nearly half received treatment with an antidepressant, alpha-2 agonist, or sleep aid. There was no change in frequency of concomitant medications by drug class over duration of study (all McNemar tests *p*s>0.15).
Mean baseline BMI z-score was 1.85 (SD=0.6), and mean final BMI z-score was 1.81 (SD=0.7). There was no significant change in BMI z-score between time points (*t*-value=0.58, *p* ns). Only metformin starting dose moderated change in BMI z-score from start to finish (F (1, 55)=4.25, p<0.05). Participants with metformin starting dose less than 1000 mg had no significant change (paired sample *t*-value=1.35, *p*>ns) in BMI z-score from start (M=1.63 (SD=0.7) to finish (M=1.72 (SD=0.7), whereas participants treated with starting dose 1000 mg or greater demonstrated significantly decreased BMI z-score (paired sample *t*-value=1.98, *p*>0.05) from start (M=2.06 (SD=0.5) to finish (M=1.85 (SD=0.6).
Conclusions:
In this naturalistic sample, metformin treatment appears to stabilize BMI z-score, but does not result in significant reduction of BMI z-score. Treatment dose appears to potentially moderate the effect of metformin, with higher starting doses resulting in greater reduction in BMI z-score over the course of treatment. Further work is indicated to determine the safety and efficacy of metformin as a treatment for medication-associated weight gain in youth with ASD.

116 **162.116** Microbiota Transfer Improves Gastrointestinal and Autism Symptoms: An OPEN Label Study

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Background: Autism Spectrum Disorder (ASD) is a complex neurobiological disorder that impair social interactions and communication and lead to restricted, repetitive and stereotyped patterns of behavior, interests, and activities. The causes of this disorder remains poorly understood, but gut microbiota, the 10^{13} bacteria in the human intestines, have been hypothesized to impact ASD because ASD-afflicted children often suffer gastrointestinal (GI) problems that correlate with ASD severity, and many previous studies have reported abnormal gut bacteria in children with ASD. The gut microbiome-ASD connection has been tested in a mouse model of ASD where the microbiome was mechanistically linked to abnormal metabolites and behavior. Similarly, a study of children with ASD found that oral non-absorbable antibiotic treatment improved GI and ASD symptoms, albeit temporarily. Here, we conducted a small open label clinical trial to evaluate the impact of Microbiota Transfer Therapy (MTT) on GI and ASD symptoms of 18 ASD-diagnosed children.
Objectives: Determine the safety and possible efficacy of MTT for treating GI and ASD symptoms.
Methods: An open-label clinical trial of MTT involved a two-week antibiotic treatment, a bowel cleanse, and then an extended duration of fecal microbiota transplant (FMT) using a high initial dose followed by daily lower maintenance doses for 7-8 weeks.
Results: The Gastrointestinal Symptom Rating Scale (GSRS) revealed an approximately 80% reduction of GI symptoms at the end of treatment, including significant improvements in symptoms of constipation, diarrhea, indigestion, and abdominal pain, and all those benefits remained improved at 8 weeks after treatment. Similarly, clinical assessments showed that behavioral ASD symptoms improved significantly, and remained improved at 8 weeks after treatment ended.
Conclusions: This exploratory, extended-duration treatment protocol thus appears to be a promising approach to improve GI and behavioral symptoms of ASD. Improvements in GI symptoms and ASD symptoms persisted for at least 8 weeks after treatment ended, suggesting a long-term impact.

117 **162.117** Multi-Site Randomized Controlled Trial of Fluoxetine in Children and Adolescents with Autism (FAB)

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Background:
Selective serotonin reuptake inhibitors (SSRIs) are commonly prescribed 'off -label' for children with Autism Spectrum Disorder (ASD) despite caution regarding their use. To date, clinical trials examining the use of SSRIs in ASD have been limited by small sample sizes and inconclusive results. The efficacy and safety of SSRIs for moderating repetitive stereotyped mannerisms in children with ASD is yet to be examined.
Objectives:

1. To determine the efficacy of low- dose fluoxetine compared to placebo, for reducing the frequency and severity of restricted, repetitive and stereotypic behaviours in children and adolescents with an Autism Spectrum Disorder (ASD).Â
2. To assess the safety of using low- dose fluoxetine.Â
3. To explore the relationship between the effectiveness of low- dose fluoxetine and the serotonin transporter genotype.

Methods:
The FAB study is a multi-site randomized controlled trial. As at October 2016, 142 participants aged between 7.5-17 years with a confirmed DSM-IV-TR diagnosis of ASD have been recruited and randomized over a 6 year period. Following pre- assessment, eligible participants are randomized to either placebo or active fluoxetine groups with medication being titrated upwards over a four-week period. Reponses to medication are monitored on a weekly/fortnightly basis using the Clinical Global Impressions Scale (CGI). The primary outcome measure is the Children's Yale-Brown Obsessive Compulsive Scale- Modified for Pervasive Developmental Disorders (CYBOCS-PDD) at 16 weeks. Secondary outcome measures include the Aberrant Behaviour Scale (ABC), Spence Children's Anxiety Scale Parent version (SCAS-P) and the Repetitive Behaviours Scale (RBS-R) also at 16 weeks. Participants were also invited to undergo genetic testing for SLC6A4 allele variants via a cheek swab. Outcome will be compared between the groups using linear (continuous outcomes) and logistic (binary outcomes).
Results:
Please note, at the time of this abstract submission results were not available but will be available during the conference time period in May 2017.

Conclusions:
The FAB study is the first adequately powered randomized controlled trial to specifically investigate the efficacy and safety of low dose fluoxetine for restricted, repetitive and stereotyped behaviours in children with ASD.

118 **162.118** Open Label Clinical Trial of Sulforaphane in School-Aged Children with Autism with Metabolomic Biomarkers

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Background:
Children with ASD have been found to have elevated markers of oxidative stress and impaired antioxidant function compared to children without autism. A previous study has shown a significant improvement in ASD symptoms after supplementing children with autism with sulforaphane; known to cause transcriptional up regulation of genes that control oxidative stress. This study reports changes in behavior of children with autism following sulforaphane supplementation.
Objectives:
The objective of this study was to explore parent- and teacher-reported changes in behavior of children with ASD following sulforaphane supplementation. A second objective was to examine the metabolomic profiles of children with ASD who supplemented with sulforaphane, comparing responders and non-responders to their siblings who did not supplement, in order to look for biomarkers that might better indicate the mechanism by which sulforaphane acts in the body.
Methods:
This was an open-label, 12-week study examining the effects of sulforaphane in children ages 5 to 22 years with clinically diagnosed autism. All subjects were enrolled at the Oak Hill School in San Anselmo, California, and had a diagnosis of ASD, or were siblings of enrolled students. The clinical diagnosis of autism was established by meeting *DSM-IV* criteria. The ASD group was given a dose of sulforaphane determined by weight, while siblings did not take the supplement. Behavioral assessments of children with ASD were collected using the Aberrant Behavior Checklist (ABC) and the Social Responsiveness Scale (SRS) at screening and close-out (week 12) from parents and teachers. Urine samples were collected from the ASD group and from their siblings, and metabolites were analyzed and compared.
Results:
Of 20 ASD subjects enrolled, five dropped out from the study because of the inability to ingest the sulforaphane tablets. Subjects with a decrease of four or more points on the ABC (n=8) were identified as responders to sulforaphane. Responders exhibited a 26.7-point decrease in total ABC ($p<0.001$) and an 18.6-point decrease in SRS ($p=0.001$) at close-out (Week 12), compared to non-significant increases of 2.9 points in ABC and 0.9 points in SRS for non-responders. Metabolomics of all subjects and siblings showed that responders had higher levels of sulforaphane-cysteine, sulforaphane, and sulforaphane N-acetyl-cysteine in their urine after supplementing than did non-responders. There were no adverse effects reported during the study and at the one-month follow-up after completion.
Conclusions:
Sulforaphane was well tolerated and seems to improve ASD symptoms as measured by ABC and SRS. There may be a subgroup of children with ASD who show a strong response to sulforaphane, while others may not show a significant response based on metabolic profile. Metabolomic analysis confirms different metabolites found in urine of responders versus non-responders in this study, and would be a future direction to pursue in research on sulforaphane in children with ASD.

119 **162.119** Psychopharmacologic Intervention for Adults with Autism Spectrum Disorder: A Systematic Literature Review

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Background: The increased recognition of psychiatric and behavioural disorder in adults with autism spectrum disorder (ASD) has been associated with more frequent use of psychopharmacologic intervention in this population. Indeed, evidence from recent research indicates that up to 81% of adults with ASD take at least one psychotropic medication, with a high proportion of these individuals taking three or more medications. The primary indicator of psychotropic medication use in this population is behavioural disturbance, often in the absence of a diagnosed psychiatric disorder. However, limited evidence supports the effectiveness of these interventions for adults with ASD.
Objectives: The objective of this review was to synthesize the literature that has explored the efficacy of psychotropic medication in reducing behavioural disturbance in adults with ASD. A secondary objective was to describe the strength of the evidence for psychopharmacologic intervention in this population.
Methods: An electronic database search of PubMed was conducted in January 2015. The literature search yielded 366 articles. Articles were included in the review if they met the following criteria: (1) the article described at least one adult (>18 years) with (a) a confirmed diagnosis of ASD, Autistic Disorder, Asperger's Disorder or Pervasive Developmental Disorder-Not Otherwise Specified, or (b) reported clinical features typical of ASD, (2) the article described at least one outcome measures, and (3) the article was published in English in a peer-reviewed journal.
Results: Â Forty-three studies were included in the analysis. The results indicated that Only two psychotropic medications, risperidone and fluoxetine, met Reichow et al.'s (2008) criteria for promising evidence-based interventions for reducing irritability and repetitive behaviour associated with ASD in adults. Evidence from two placebo-controlled trials, in addition to one case series, indicated that fluoxetine results in a reduction in repetitive and obsessive-compulsive behaviour in adults with ASD. Similarly, the results of two placebo-controlled trials, in addition to two small open-label trials, indicate that risperidone may be effective in reducing repetitive, aggressive and self-injurious behaviour in adults in this population. The efficacy of all remaining agents has been investigated in case studies or small open label trials, so the evidence base for these interventions cannot be established.
Conclusions: Despite high rates pf psychopharmacologic intervention in ASD, there are few psychotropic medications which can be considered to have an established evidence base. Given the lack of evidence-base for psychopharmacologic intervention for adults with ASD, there is an imperative to conduct placebo-controlled trials that measure the safety, efficacy and tolerability these interventions when used to treat features associated with ASD. It is also necessary to establish clinical guidelines governing the use of psychopharmacology in this population.

120 **162.120** Systematic Screening of Pharmacological Compounds in Human Pluripotent Stem Cells-Derived Neurons to Identify Patient-Oriented Treatment for Autism: A Proof of Concept

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Background:
Autism spectrum disorders (ASD) affect millions of individuals worldwide but the heterogeneity of the symptoms lead to therapeutic intervention choices often based on 'trial and error'. A versatile yet relevant cellular model developed to rationally screen among hundreds of therapeutic options in a patient-oriented manner would help improving clinical practice.
Objectives:
Here we investigated whether neurons differentiated from pluripotent stem cells can provide such a tool using ASD associated to *SHANK3* haploinsufficiency as a proof of principle.
Methods:
Pharmacological FDA approved compounds (N=205) were screened first for their potential to increase *SHANK3* mRNA content in neurons differentiated from control human embryonic stem cells using Taqman probes in a fully automated process. Successful compounds were then challenged for efficacy at correcting pathological phenotypes in neurons differentiated from individuals with deleterious *SHANK3* point mutations using the induced pluripotent stem cell derived from the patients.
Results:
Among the 205 compounds tested, 15 increased significantly SHANK3 expression, including 6 FDA-approved drugs. Further investigation demonstrated that 2 of the latter, lithium and valproic acid, efficiently increased SHANK3-containing synapses and neuronal connectivity. These 2 drugs were efficient at correcting functional phenotypes associated with *SHANK3* haploinsufficiency in patient-derived neurons. Lithium pharmacotherapy was then tested in one patient. After one year, a clinically-significant decrease in symptom severity has been observed.
Conclusions:
Pluripotent stem cells-derived neurons can help define more specific treatment for autism by focusing on gene or pathway correction rather than on symptoms. They allow the pre-screening of hundreds of therapeutic options on patients-derived neurons, thus increasing the chance of success of a candidate treatment.

121 **162.121** The Effects of Four Weeks of Intranasal Oxytocin on Social Responsiveness and Repetitive and Restricted Behaviors in Autism Spectrum Disorders: A Randomized Controlled Trial

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Background:
Autism spectrum disorders (ASDs) are characterized by impairments in social communication and interaction and repetitive and restricted behaviors. To date, no pharmacological treatment exists targeting the core symptoms of ASD, yet the past years, the pharmacological use of a neuropeptide, called oxytocin (OT), has gained increasing interest from the research community to explore its potential for elevating the core social deficits in ASD. OT is known to play a pivotal role in a variety of complex social behaviors by promoting a prosocial attitude and interpersonal bonding. Previous studies showed that exogenously administered OT can affect trust and feelings of attachment insecurity, reduce repetitive and restricted behaviors and increase social cognition.
Objectives:
A double-blind randomized placebo-controlled trial with thirty-four young adult men with ASD (17 OT/ 17 Placebo (PL)) was conducted to assess behavioral effects of OT therapy (i) at baseline; (ii) after four weeks of daily nasal spray administration; and (iii) four weeks post-treatment to assess potential retention effects.
Methods:
Doses of 24 IU oxytocin (Syntocinon®, Sigma-tau) or placebo nasal spray (PL) (saline natrium-chloride solution) (3 puffs in each nostril) were administered daily for four weeks.
Primary outcome measures to assess treatment effects included the Social Responsiveness Scale (SRS) and the Repetitive Behavior Scale – Revised (RBS-R). Secondary outcome measures included assessments of changes in attachment (State Adult Attachment Scale (SAAM); Inventory of Parent and Peer Attachment (IPPA)); assessments of changes in mood state (Profile of Mood States questionnaire (POMS)); and assessments of changes is reports of quality of life (World Health Organization Quality of Life questionnaire (WHOQOL)). All participants were characterized using IQ and ADOS-scales. Thirty-four male individuals with ASD are currently enrolled in the study and recruitment is still ongoing.
Results:
After four weeks of OT nasal spray administration, self-reports on repetitive and restricted behaviors (RBS-R) were shown to be tentatively reduced in the OT group, not in the PL group ($F(1, 31)=3.83$, $p=0.06$) and of note, the effect of OT persisted until one month after the treatment (retention: $F(1, 31)=4.02$, $p=0.05$). Immediately after the four weeks of treatment, we found no significant effects of OT on social functioning as assessed using self- and informant-based reports of the SRS. Interestingly however, at the retention session, a significant effect was revealed for the informant-based SRS ($F(1, 22)=4.90$, $p=0.04$), indicating that clear improvements in social responsiveness emerged one month after cessation of the actual treatment (specifically for reports of social motivation ($F(1, 22)=4.71$, $p=0.04$) and social communication ($F(1, 22)=7.39$, $p=0.01$)).
For the secondary outcome measures, only tentative effects were revealed, indicating improvements in self-reports of attachment immediately after the four-week treatment ($F(1, 32)=3.32$, $p=0.08$) (IPPA) and improvements in the experience of social relationships at the retention session one-month post-trial ($F(1, 31)=3.07$, $p=0.09$) (WHOQOL).
Conclusions:
The observed improvements after four weeks of daily treatment with intranasal OT in our primary outcome measures (assessing social responsiveness and repetitive and restricted behaviors) indicate that OT can induce long-term behavioral changes in individuals with ASD that outlast the time of intervention.

122 **162.122** The Effects of Oxyotcin on Socially Rewarded Learning in Autism Spectrum Disorder

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Background: The neuropeptide oxytocin plays an important role in social cognition and behavior and has emerged as a promising candidate for targeting social impairment in ASD. While several studies have shown beneficial effects of oxytocin on core social deficits in ASD only a few studies have examined the underlying neural mechanisms. The social motivation hypothesis of autism posits that core deficits arise from an early failure to attach reward value to social stimuli. Despite converging evidence that important functional interactions exist between oxytocin and dopaminergic reward circuits, no studies have directly examined the effects of oxytocin on reward processing in ASD. Previous research has shown that, relative to typically developing children, those with ASD exhibit impairment in reward-related learning as well as reduced frontostriatal response to social reward (Scott-Van Zeeland et al., 2010).
Objectives: This study examined the acute effects of oxytocin on socially rewarded learning and the associated neural circuitry in ASD.
Methods: In a double-blind, placebo-controlled crossover study, 17 adults with ASD underwent functional magnetic resonance imaging (fMRI) after receiving a single dose (24 IU) of intranasal oxytocin or placebo on 2 days separated by 3-5 weeks. The fMRI paradigm, adapted from Scott-Van Zeeland and colleagues, was a probabilistic learning task that required participants to view fractal-like images and classify them into “Group 1” or “Group 2”. Social feedback (e.g., a smiling or sad face for correct and incorrect reward trials, respectively) was provided after each response to guide the learning of stimulus-response associations.
Results: Although the task was designed to allow for improvement in classification accuracy, participants’ performance remained at chance levels over the course of the placebo scan, suggesting a deficit in implicit learning consistent with Scott-Van Zeeland et al. Furthermore, we found no effect of oxytocin on implicit learning. At the neural level, social feedback was associated with activity in “social brain” regions, such as the fusiform gyrus bilaterally, the orbitofrontal cortex, and the inferior frontal gyrus (Brodmann’s Area 44), following both oxytocin and placebo administrations. No selective effects were observed for oxytocin relative to placebo in response to social feedback across both correct and incorrect trials. However, when examining the neural response to positive vs. negative social feedback (i.e., happy vs. sad faces), oxytocin yielded significantly greater activity than placebo in the striatum, the medial prefrontal cortex, and the fusiform gyrus.
Conclusions: These findings are consistent with recent work in healthy controls showing that oxytocin may selectively bias attention to positive social cues (Domes et al., 2013). While some studies suggest that oxytocin results in enhanced social brain activity more broadly in ASD, we observed a selective effect of oxytocin in response to happy faces following rewarded trials. The lack of improvement in implicit learning following oxytocin could reflect task difficulty or insufficient dosing or length of treatment. Future research should examine the effects of different doses of oxytocin, as well as sustained and augmentative treatment effects.

123 **162.123** Trends in the Use of Psychotropic Medication for Children with Autism Spectrum Disorders on Kentucky Medicaid

***W. D. Lohr**, Y. Feygin, G. C. Liu, M. J. Smith, M. D. Stevenson, D. W. Davis, P. G. Williams, C. Woods and J. Myers, Pediatrics, University of Louisville, Louisville, KY*

Background:
Children with Autism Spectrum Disorder (ASD) are often treated with multiple medications despite limited evidence of efficacy. Existing data of controlled trials of psychotropic medications (PM) show children with ASD have lower response rates than typically developing children and higher rates of side effects. The treatment of children with ASD with polypharmacy including antipsychotic medications (APM) is a public health concern important to providers and policy makers.
High rates of PM use for youth with ASD have been reported in several studies with increased trends in polypharmacy influenced by regional differences, age, and psychiatric comorbidity. Rates of polypharmacy in ASD are markedly higher for youth in foster care. However, studies are needed to document more recent trends.
Objectives:
This poster will examine recent trends of PM use, APM use, and interclass polypharmacy for children with ASD receiving KY Medicaid including those children in foster care. The influence of seizures and intellectual disability on these rates will also be examined.
Methods:
Medicaid claims from 2013-2015 for diagnosis of ASD were analyzed for children <18 years old and stratified by foster care, intellectual disability and seizure disorders. Polypharmacy was defined by interclass polypharmacy from at least 2 classes for ≥90 days with less than a 7-day gap.
Results:
The total number of youth < 18 with ASD on Kentucky Medicaid was 6952 in 2013, 7674 in 2014, and 8715 in 2015. The number of these youth treated with a PM for > 90 days was 2720 (39.1%) in 2013, 3727 (48.6%) in 2014 and 4186 (48.0%) in 2015. The number of youth treated with APM for > 90 days was 1308 (18.8%) in 2013, 1649 (21.4%) in 2014 and 1633 (18.7%) in 2015. The number of youth receiving interclass polypharmacy > 90 days was 1585 (22.8%) in 2013, 2179 (28.3%) in 2014, and 2392 (27.4%) in 2015. Less than half of children received psychosocial therapy.
All rates of PM, APM use, and polypharmacy are much higher for those children with ASD in foster care. For example, the rate of APM use for children 13 to 18 years old with ASD in foster care was 59.5% in 2015 compared to 27.1% for same aged children in Medicaid non-foster. Rates of polypharmacy with ≥ 4 medications are much higher for children with ASD and a diagnosis of seizures, (for 2015, 24.4% of children with ASD and seizures vs. 12.5% for children with ASD without seizures.) Rates of polypharmacy do not appear significantly influenced by the presence of intellectual disability.
Conclusions:
The rates of PM use and rates of interclass polypharmacy in youth with ASD on KY Medicaid are in line with estimates from other states but show a marked increase from 2013 to 2015. Rates of polypharmacy in ASD are influenced by the diagnosis of seizures but not intellectual disability. Continued monitoring for quality and safety indicators of PM use is needed for children with ASD on KY Medicaid and for those in foster care.

Poster Session
163 - Molecular and Cellular Biology
5:00 PM - 6:30 PM - Golden Gate Ballroom

124 **163.124** Autism-Linked Gene Products Form an Activity-Dependent Signaling Network at the Synapse

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Background: Among the hundreds of genes that contribute to autism risk, there is significant enrichment of genes expressed at the synapse. These genes include neurotransmitter receptors, scaffolds, and signal transduction molecules that bind to each other, often using protein-protein interaction motifs that can be modified by activity-inducible kinase activty. However, it is not clear how or if the protein products of these genes act together to perform a coordinated cellular function.
Objectives: To define activity-dependent changes among a protein interaction network composed of autism-linked, synaptic gene products.
Methods: We used quantitative multiplex immunoprecipitation and computational modeling of dynamic protein-protein interaction networks to define a "protein interaction network signature" associated with various experiemental manipulations, including neuronal stimulation (with KCl, glutamate, or specific agonists) or autism-linked genetic insults.
Results: We developed a synaptic multiplex assay based on the protein products of autism candidate genes, measuring ~400 binary interactions. Genes were selected based on genetic linkage with autism, synaptic localization, known interactions with other autism risk factors, and antibody availablilty. Using this technology, we first stimulated wild-type neurons with KCl or glutamate, and found activity-dependent changes in 20+ protein-protein interactions (PPIs) among this network of autism-linked proteins. We then performed a screen of 7 different mouse models of autism, and found altered protein-protein interactions in each ASD model (compared to wild-type littermates). Some altered PPIs were shared among models, some were unique to certain models. We found significant enrichment of activity-dependent PPIs among those that were identified in the ASD models. Focusing on 3 ASD models (Shank3, FMR1, & Ube3a overexpressing mice) we find genotype-specific differences in the PPI network response to activity. Principle component analysis shows seperation of experimental groups by both genotype and stimulation status, while our statistical analysis identified specific interactions driving PCA seperation. Finally, we treated FMR1 neurons with mGluR antagonists known to correct morphological and behavioral deficits, and observed corresponding changes in the PPI signiture, suggesting a mechanism of drug action.
Conclusions: The protein products of autism-linked genes form a dynamic, activity-dependent protein interaction network at the glutamate synapse. Disruption of information flow through a protein interaction network comprised of synaptic ASD-linked genes may contribute to autism pathogenesis.

125 **163.125** Autism-Related Mutations in the CEP290 Gene Alter Cell Signaling at the Primary Cilium.

M. Kilander *and Y. C. Lin, Hussman Institute for Autism, Baltimore, MD*

Background: Whole exome sequencing has identified mutations in the centrosomal protein CEP290 in individuals with autism. This large protein is a crucial component in the formation and function of the primary cilium and thus is one of the main risk genes in ciliopathies, e.g. Joubert Syndrome, Meckel Syndrome and Bardet-Biedl Syndrome. Interestingly, defects in cerebellar development and autistic traits are occasionally observed in these ciliopathy patients, however, in combination with severe multi-organ dysfunctions phenotypes. The primary cilium is a microtubule rich cell protrusion important for cell proliferation, differentiation and migration. Moreover, the primary cilium serves as the confined compartment for selective cell signaling and for cell-environment communication. Sonic Hedgehog (Shh) signaling, a biological pathway necessary for proper tissue development and maintenance, is preferentially localized to the primary cilium and is essential for proliferation of granule cell progenitors (GCP) during cerebellar development. However, to date little is known about the role of the primary cilium in neurodevelopment and in the establishment of mature neural circuits. In addition, the role of CEP290 in regulating brain function is still unclear.
Objectives: Here, we test the hypothesis that autism-associated mutations in CEP290 alter the function and molecular structure of primary cilium on cerebellar GCPs and ultimately affect their proliferation or differentiation during critical stages of brain development.
Methods: We employ live cell imaging, immunocytochemistry and molecular techniques to assess the changes in morphological, proliferative and cell signaling mechanisms caused by mutations in *CEP290*. Using the IncuCyte™ (Essen Bioscience) automated cell monitoring system we are able to perform detailed analysis on changes in proliferation and migration, as well as neurite formation and establishment in cell cultures expressing CEP290 mutant proteins.
Results: Overexpressed CEP290 wildtype as well as mutant proteins localize to the base of the primary cilium in NIH/3T3 cells and do not perturb ciliary formation. However, we find that cell proliferation rates are affected. When using a Shh response reporter, Glix8-EGFP, we observe that cells expressing CEP290 mutants show defects in response to Shh stimulation. Moreover, fluorescence recovery after photobleaching (FRAP) analysis of the mobility of proteins present in the primary cilium indicates that mutant CEP290 might play a role in disruption of the dynamics of the ciliary molecular signaling platform needed for proper Shh pathway activation.
Conclusions: Our present research suggest a link between autism-associated mutations in the *CEP290* gene and abnormal ciliary protein dynamics and Shh signaling. Thus, our ongoing investigation will aim to provide novel insight on the function of the primary cilium in neurological conditions and in regulating brain development.

126 **163.126** Comparative Expression Analysis of Autism-Associated Cadherin Superfamily Members

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Background:
Cell adhesion molecules (CAMs) play crucial roles in neural circuit formation. The cadherin superfamily is one of the largest families of CAMs containing more than one hundred molecules, including classical cadherins type I and II, protocadherins, and atypical cadherins. The type I classical cadherin N-cadherin/CDH2 is the most well-studied member to-date. N-cadherin functions throughout the development of nervous system including neurite outgrowth, axon guidance, synaptogenesis, spine morphogenesis and plasticity. Although there is only little known about the function of other cadherins they have been strongly implicated in autism. A genome wide association study performed by the Hussman Institute for Human Genomics identified the classical cadherin type II CDH8, CDH9 and CDH11, the protocadherin family member PCDH9 and the atypical cadherin FAT1 as candidate risk genes. This suggests that cadherin signaling pathways could be disrupted and may display increased vulnerability in autism.
Objectives:
As a first step toward understanding the central role of cadherins in the etiology of autism, we focus on CDH8, CDH9, CDH11, PCDH9 as well as FAT1 and investigate the expression pattern of these cadherins in specific brain areas, cell types and their subcellular localization during development. This comparative expression analysis could provide novel insights into common and distinct functions of these cadherins in neural circuit formation.
Methods:
SDS-PAGE and Western blot analyses were performed to evaluate the protein expression of CDH8, CDH9, CDH11, PCDH9 and FAT1 in the developing mouse brain of embryonic day 14 (E14), postnatal day 0 (P0), P7, P14 and P21 and adult as well as in different brain areas. To analyze the cellular localization, primary neurons from different brain regions were cultured for 4 days *in vitro* and co-stained for cadherins and neuronal marker MAP2.
Results:
Temporal expression analysis in the developing mouse brain revealed increased expression of CDH8, CDH11 and PCDH9 from stages P7 to P14. In contrast, CDH9 expression peaked earlier in development between E14 and P7. The expression pattern of FAT1 was distinct from the other cadherins as its level was high at E14, decreased at P0 and was elevated again from P7 throughout P21. Analysis of specific brain areas showed that CDH8, CDH11 and PCDH9 were prominently expressed in the cortex, hippocampus and midbrain/striatum whereas FAT1 expression was restricted to the cerebellum. In line with these results, cellular localization of CDH8, CDH9, CDH11, PCDH9 and FAT1 expression was observed in the dendrites of cortical and cerebellar granule neurons, respectively.
Conclusions:
Our results revealed similar expression profile among CDH8, CDH11 and PCDH9, with distinct expression patterns for CDH9 and FAT1. A peak of cadherin expression between P7 and P14 as well as cellular localization in dendrites is consistent with the proposed functions of cadherins in dendritogenesis and synaptogenesis. The brain areas that revealed the highest cadherin levels overlap those reported as associated with autism. Taken together, this analysis highlights that cadherins of different subfamilies are expressed in a developmental time window and in brain areas that are often affected in autism.

127 **163.127** Cyfip1 Regulates Presynaptic F-Actin Polymerization and Synaptic Vesicle Release during Development.

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Background: Copy number variations in *CYFIP1* have been associated with multiple developmental brain disorders including autism spectrum disorders and schizophrenia. In Angelman and Prader-Willi syndromes chromosome deletions including *CYFIP1* have been associated with more severe symptoms than deletions sparing it. *CYFIP1* encodes a cytoplasmic protein, Cyfip1 (cytoplasmic FMRP interacting protein), which has two distinct functions:
i) Suppressing mRNA translation initiation.
ii) Promoting the generation of branched F-actin filaments at the plasma membrane as a component of the WAVE regulatory complex (WRC).
Objectives: While regulation of protein translation and actin polymerization are highly independent processes, they are both essential for the generation of normal synapses. Based on this we asked whether Cyfip1 coordinately regulates both processes when synapses are first forming.
Methods: To examine the role of Cyfip1 in synapse development, we assayed several parameters of synapse composition and function in hippocampus or in hippocampal neurons cultured from mice haploinsufficient for *Cyfip1* and compared the data to wild type littermates (all on a C57BL/6J background). Mechanistic studies were carried out in neurons cultured from rat hippocampus in which Cyfip1 levels were reduced using shRNA and then rescued with full length Cyfip1 resistant to the effects of the knockdown or Cyfip1 mutant constructs. Presynaptic function was assessed in field recordings of Schaeffer collateral synapses in CA1 or in cultured neurons using synapto-pHluorins or FM-dye uptake and release. Distribution of synaptic markers and F-actin were evaluated in fixed sections or in cultured neurons using immunostaining or tagged Phalloidin, respectively, using masks generated in Image J or SynD for image analysis. Differences between groups were compared using Prism. We are currently testing whether F-actin is driven into distinct or alternate patterns when Cyfip1 levels are reduced using super-resolution microscopy.
Results: Our data show that reducing levels of Cyfip1 serves to increase presynaptic terminal size and increase release probability in field recordings in mice hippocampal slices. shRNA knockdown of Cyfip1 that is restricted to presynaptic neurons recapitulates these effects in contrast to postsynaptic knockdown, which had no effect. The effects of Cyfip1 knockdown can be rescued by co-expression with a full length Cyfip1 protein or by a Cyfip1 mutant lacking the ability to suppress protein translation. A mutant unable to interact with WRC was unable to rescue the effects on synapses. The data observed also shows that in neurons having reduced levels of Cyfip1, F-actin intensity is greater at presynaptic terminals, but unchanged elsewhere in the neurons.
Conclusions: Our data support that in developing synapses Cyfip1 regulates synaptic vesicle cluster size and release probability via its participation in the WRC. Reduced Cyfip1 levels lead to a selective increase in the levels of presynaptic F-actin suggesting the recruitment of an alternate or compensatory actin polymerization pathway. Hence, pathway dependent small molecule inhibitors of actin polymerization may ultimately have therapeutic potential.

128 **163.128** Deciphering Regulatory Networks of Autism Risk Genes: High Resolution Networks Using Ex Vivo and In Vivo Models of Neurodevelopment.

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Background:
Recent gene discovery efforts in autism spectrum disorder (ASD) have identified regulatory genes such as the chromatin remodeler *CHD8* to be important new contributors to ASD etiology. These and other ASD risk-associated genes are enriched in co-expression networks built from studies of gene expression in human midfetal cortex, suggesting that ASD pathogenesis may result from perturbation of member genes of these regulatory networks. Recently, we demonstrated that CHD8 regulates other ASD risk genes in human brain and human neural stem cells (hNSCs). Strikingly, CHD8 target genes are enriched for ASD risk genes that regulate gene expression, such as *POGZ* and *CHD2*, and this targeting is also detectable in mouse cortex.
Objectives:
To investigate ASD risk associated regulatory networks with high temporal and spatial resolution, we have undertaken studies to globally map regulatory targets of ASD risk-associated chromatin modifiers at an early stage of human neurodevelopment, and in specific cell types and brain regions during mouse embryonic cortical development.
Methods:
We are mapping the binding sites of CHD8, POGZ, and CHD2 in hNSCs using ChIP-seq. To facilitate uniform ChIP-seq methods, we have incorporated epitope tags using genome editing. To characterize global CHD8 targets in the developing mouse brain, we have generated a mouse line with a cre-activated epitope tag to allow purification of CHD8 complexes from specific cell types using cre driver lines.
Results:
Genome editing in hNSCs integrates epitope tags into the endogenous loci of selected ASD risk genes consistently and robustly. ChIP-seq performed with antibodies directed to the epitope tag in CHD8-tagged cells verifies ChIP-seq performed with native antibodies, and identifies additional ASD risk genes as CHD8 targets. Genome editing in mouse embryos has generated a similar epitope-tagged Chd8 gene in mice, and we are engaged in on-going efforts to characterize the Chd8 binding sites in specific cell-types using ChIP-seq.
Conclusions:
Correlation of ASD risk gene target maps with each other, and with maps of specific active and/or repressive histone modifications, will identify genes and regulatory elements commonly targeted by other ASD risk genes that are impacted by the CHD8 regulatory network.

129 **163.129** Establishment of a Human Induced Pluripotent Stem Cell-Based Model of Kleefstra Syndrome

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Background: Kleefstra syndrome (KS) is a rare genetic disorder that presents with a clinical phenotype including developmental delay, childhood hypotonia as well as distinctive facial features and may be associated with symptoms of autism spectrum disorder (ASD). Investigations using the induced pluripotent stem cell (iPSC) technique to model homogeneous populations of autism-related syndromes with well-known, monogenic backgrounds have been done in Fragile X, Rett, Phelan-McDermid and Timothy syndromes yet, there has been no report on in vitro modeling of KS.
Objectives: The aim of the present study was to establish a patient-derived in vitro disease model of KS accompanied by ASD (KS+ASD) using the iPSC technology.
Methods: Blood samples from a patient with KS+ASD carrying a premature termination codon mutation in the euchromatic histone lysine methyltransferase 1 (EHMT1) gene and two healthy subjects were taken after ethical approval and obtaining written informed consent. Diagnosis of the subjects was confirmed with ADOS and ADI-R. Mononuclear cells were isolated from the blood and genetically reprogrammed by a non-integrating gene delivery system. Differentiation of iPSCs into neuronal precursor cells and glutamatergic neurons was induced by a dual-SMAD inhibition protocol. Neurite morphology was measured by using an Operetta® High Content Imaging System (PerkinElmer). EHMT1 gene expression was investigated by using reverse transcription-quantitative PCR and Western blotting.
Results: The iPSCs showed embryonic stem cell morphology, normal karyotype, expressed pluripotency markers, and were able to spontaneously differentiate into cells of the three germ layers. iPSCs were successfully differentiated into neurons; this was demonstrated by neuron specific immunolabeling for MAP2 and NF200, electronmicroscopic visualization of synapses and electrophysiological detection of ionic (sodium, potassium) currents and action potentials. Determination of EHMT1 mRNA and protein expression demonstrated functional haploinsufficiency of the gene in the patient-derived cell cultures. iPSC-derived neuronal cell cultures were investigated in order to detect any substantial phenotypical differences between neurons originated from the KS+ASD case and neurotypical subjects. Neurite morphology was significantly compromised on multiple endpoints, including full and maximal length of neurites, number of neurite roots and endings in the KS+ASD condition in comparison to controls. The number of dendritic protrusions (filopodia or immature dendritic spines) was also reduced in the KS+ASD cultures compared to controls. Calcium currents evoked by glutamate did not differ between KS+ASD and controls however, administration of acetyl-choline induced larger calcium currents in the KS+ASD cell cultures. Gene expression patterns of 180 ASD-associated candidate genes were investigated by qRT-PCR, showing significantly altered expression of ARX, SIX3, and HCN1 genes relative to both controls.
Conclusions: The present iPSC-derived neuronal cultures represent an excellent in vitro model system for KS which may serve to obtain a better understanding of the underlying pathophysiology of KS and potentially that of ASD.

130 **163.130** Folic Acid Attenuates Fragile x Mental Retardation Protein Expression in Lymphoblastoid Cells By Activating DNA Methyltransferases

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Background: Autism spectrum disorders (ASDs) a group of highly heterogeneous, neurodevelopmental disabilities characterized by impairments in social interactions; deficits in verbal communication; and stereotyped, repetitive patterns of behaviors, have a current prevalence of 1 in 68 children. Reports have indicated that their etiology includes shared heritability and environmental factors, many of which remain elusive. Gender disparity, in that boys are 4.5 times more likely than girls to have an ASD, has been reported, suggesting the involvement of the X chromosome or of defects in genomic imprinting as plausible causes.
Objectives: We examined whether environmental epigenetic dysregulation during gestational development plays any contributing role in ASD. Specifically, we studied the effects of excessive folic acid (FA) supplementation on gene expression, which may play a role in fetal brain development, culminating in the onset of psychiatric conditions later in life. FA is an essential vitamin recommended during pregnancy for the prevention of neural tube defects in infants, which also induces epigenetic changes in gene-regulatory DNA sequences. Prescriptions for daily doses of FA, along with the presence of FA in over-the-counter medicines and energy drinks, together with enriched flour, are providing an excessive supply of FA, the physiological significance of which to the developing fetus is unknown. We have previously shown widespread dysregulation of gene expression in lymphoblastoid cells and in the C57BL mouse model after excessive FA supplementation.
Methods: In the present study, we used a combination of Western blot analyses, DNA sequencing following bisulfite treatment of genomic DNA, and enzyme assays in lymphoblastoid cells to identify the effect of excessive FA supplementation on the expression of the *FMR* gene.
Results: We found a time- and concentration-dependent decrease in the expression of the fragile X protein (FMRP) in response to FA supplementation. The decreased FMRP expression persisted for more than 48 hours after the withdrawal of FA, suggesting a possible lasting epigenome modification. Bisulfite sequencing of DNA from cells treated with low- and high-FA-supplemented cell cultures revealed the methylation of specific cytosine residues around the promoter region and transcription initiation site, indicating possible enzyme-mediated epigenetic modifications. Furthermore, we found that FA supplementation stimulated the activities of the DNA methyltransferases (DNMTs) 1, 3A, and 3B in lymphoblastoid cell extracts. These enzymes are involved in genomic DNA methylation.
Conclusions: These results demonstrate that FA supplementation of lymphoblastoid cells can cause stimulation of DNMTs that contain FA as coenzymes, leading to the increased methylation of specific cytosine residues in the gene promoter, thereby affecting protein expression.

131 **163.131** Gene Expression Profiling of PTEN Knockout Embryonic Cultured Neuron Shows Differential Expressed Genes Overlapping with Human Autism Candidate Genes Converging to Common Pathological Pathways

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Background: Patients with PTEN Hamartoma Tumor Syndrome (PHTS) harboring germ line PTEN mutations are known to be associated with autism spectrum disorders (ASDs). Studies in PTEN knockout mice demonstrated defects in different social interaction behaviors and the critical role of the phosphatidylinositol 3-kinase (PI3-K) signaling pathway. Neuromorphological studies showed that PTEN loss could lead to macrocephaly, enlarged neuronal cell bodies with hypertrophic dendrites and axonal tracts with increased number of synapses. Microarray and transcriptomic studies of neurospheres and neural tissues with PTEN loss were reported, respectively. However, the spectrum of downstream genetic elements which govern these neuromorphological and behavioral changes are still not fully characterized.
Objectives: We sought to determine the gene expression profile of PTEN knockout neurons in order to delineate possible molecular mechanisms underlying the neuropathological changes which lead to ASDs.
Methods: Primary neurons from E15.5 frontal cortices of wild-type and nestin-positive neural progenitor specific PTEN knockout mice were obtained and cultured for 5 days or 14 days. RNA samples were harvested from three control and three PTEN knockout neurons from littermate mice and analyzed by HiSeq transcriptome sequencing. In order to identify functional pathways affected by PTEN deletion, differential expressed genes (DEGs) were analyzed by gene ontology and pathways enrichment. To further investigate ASDs related pathway dysfunctions, DEGs with q-value <0.05 were compared with ASDs associated genes from the SFARI repository. Common genes from both lists were further analyzed by pathways enrichment.
Results: Over four hundred upregulated and around one hundred downregulated DEGs were identified comparing primary neurons with or without PTEN. Comparing all genes with q<0.05 and ASDs associated genes from the SFARI repository, almost two hundreds common genes were identified. Amongst these, thirty-one DEGs (including both up- and down-regulated) with fold change >2 were identified. Both gene lists converged at common functional pathways – focal adhesion and extracellular matrix-receptor interaction – which are also the top two enriched pathways within individual gene lists.
Conclusions: Â Our results show genes and related functional pathways that are perturbed with PTEN deletion in neuron. The comparison with ASDs associated genes helps us to focus on pathways that are commonly shared and affected in ASDs. Furthermore, these results can allow us to focus on genes and molecular pathways that may be responsible for the neuropathological changes. Their further functional characterization may generate novel targets for treating this neurodevelopmental disorder.

132 **163.132** Immune Cellular Phenotypes in Blood of Children with Autism Spectrum Disorder- a Pilot Study

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Immune cellular phenotypes in blood of children with Autism spectrum disorder- a pilot study

Background:
Immunological abnormalities has been proposed to contribute to the pathophysiology of Autism Spectrum Disorder (ASD). In order to further elucidate this role, there is a need to study the immunological parameters in a comprehensive manner in ASD.
Objectives:
To study the immune cells in the peripheral blood of children with ASD in comparison with typical developing children.
Methods:
Twenty children (3 to 12 years of age) with ASD (DSM 5 criteria), were recruited from Child and Adolescent Psychiatry services, National Institute of Mental Health and Neurosciences, Bangalore. Age and sex matched twenty typically developing children were recruited as controls. The frequencies of various subsets of T cells, B cells, Monocytes, Natural Killer Cells and Dendritic Cells in the peripheral blood were characterised using 26 markers according to Human Immunology Project Consortium guidelines.
Results:
On preliminary analysis, we did not find any significant difference in subsets of Monocytes, Dendritic cells, Natural Killer cells and B cells in children with ASD when compared to typical developing children. There are few differences between the 2 groups in some of the subsets of T cells.
Conclusions:
There appears to be no difference in innate and humoral immune cell subsets in children with ASD in our study. Larger studies with higher sample size are required to validate this finding. Further, immune changes in T cells found in our initial analysis adds on to the previous literature that implicates T cell abnormalities in ASD. Final results of our study will be discussed.

133 **163.133** Innate Immunity in Autism Spectrum Disorders with Digestive Difficulties

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Background:
Among patients with Autism Spectrum Disorders (ASD), there is a high percentage suffering from functional Gastrointestinal Disorders (fGID). Some fGID have been thought of reflecting a systemic proinflammatory status. Evidence from different sources points towards the possibility that systemic innate immune/inflammatory mechanisms play an important role in some cases of ASD. The link between these potentially linked physiopathological markers has been hardly studied.
Objectives:
To explore whether a subset of children with ASD and fGID shows abnormalities in the Toll-like receptors (TLR4) proinflammatory signalling pathway.
Methods:
This study included 53 subjects: 35 children with ASD (15 without- and 15 with fGID) and 20 controls (13 with and 5 without fGID). Mean age was 6.33 (range 3-10). 90 % were male. ASD was diagnosed following the AACAP recommendations (Volkmar, 2014) and fGID were assessed with the ROMA-III. Innate immune system: we assessed i and ii) Toll-like receptors 2 and 4, ii) Myeloid differentiation primary response gene 88 (MyD88), inicial element of this pathway and iv)TIR-domain containing protein TRIF (the sole adaptor of TLR3). Bivariate analyses were conducted in order to compare the levels of the different markers between subjects with ASD and without ASD and patients with and without fGID. ANCOVA analyses were conducted, with each marker as independent variable, and fGID status as covariate, to check for differences between ASD and no-ASD groups (fixed factor).
Results:
Kruskal-Wallis statistic showed that patients with ASD had higher PBMC levels of MyD88 than controls (31.77 and 17.72 respectively, chi-square 9.837, p=0.002). TLR-2 and TLR-4 were non-significantly higher in ASD than in controls (TLR2: 28.91 vs 23.28 p=0.071; TR4: 29.74 vs 21.67, p=0.071) and significantly higher in patients with fGID than in patients without fGID: TLR-4 (21.15 vs 36.65, p=0.000); TLR2 (30.76 vs 20.80 p=0.023). ANCOVA analysis confirmed that there was a diagnostic group effect on My88D and a fGID effect on TLR4 and TLR2 (See Table).
Conclusions:
There seems to be a systemic proinflammatory status in patients with fGID irrespective of the presence of a diagnosis of ASD. ASD patients, irrespective of the presence of fGiD, show makers of activation in very early steps of the innate immune system. It seems worth studying the immunological pathophysiology of ASD for the ultimate goal of finding distinct subgroups of patients that can benefit for specific interventions.
Bergeron JD,Â et al Dev Neurosci.Â 2013;35(6):504-15.
Lucas and Maes Mol Neurobiol 2013: 48:190–204

134 **163.134** Investigating E6AP Target Genes in Autism Spectrum Disorder

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Background: ASD has been found to be associated with duplication or triplication of the UBE3A gene, which encodes for E6-associated protein (E6-AP, an E3 ubiquitin ligase). Mice with three copies of UBE3A exhibit core ASD features and humans with Dup15q share many symptoms with ASD. However, the few E6-AP ubiquitination substrates found do not explain ASD pathology. Our lab has identified and characterized E6-AP as a coactivator of estrogen receptor (ER) α signaling. Estrogens (E2) affect learning, memory and many other brain processes via ERs, which are transcription factors.
Objectives: This study tests the hypothesis that deregulation of E6-AP-mediated ERα transcriptional signaling in the brain leads to the development of ASD. The project aims are to identify E2-dependent E6-AP target genes in neurons and to study the role of these target genes in the pathogenesis of ASD. Identification of new molecular pathways that are transcriptionally regulated by E6-AP will broaden our understanding of ASD.
Methods: Potential E6-AP target genes were identified by microarray of MCF-7 breast cancer cells. Cells from the mouse neuroblastoma Neuro2a cell line or mouse hippocampus were cultured. Cells were transfected with E6-AP or had E6-AP knocked down by siRNA and then were treated with physiologically relevant doses of estrogen, the ER antagonist tamoxifen, or vehicle. Assays included western blot, co-immunoprecipitation, chromatin immunoprecipitation, luciferase assay, qRT-PCR, and microscopy.
Results: 1) E6-AP and ER colocalize in mouse HPC neurons. 2) E6-AP and ERα translocate to the nucleus of Neuro2a (N2a) cells upon E2 treatment. 3) E6-AP and ERα complex in N2a. 4) E6-AP is essential for E2-ER-activated Cyp26b1 gene expression (encoding for a retinoic acid (RA) catabolizing enzyme essential to the learning, memory, and neurological pathways that are impaired in ASD) in N2a and for RA receptor β expression (Figure 1). 5) Putative E2 Responsive Element (ERE) motif from the Cyp26b1 promoter is functional in a luciferase reporter gene assay (Figure 2). 6) ER and E6-AP are recruited to the Cyp26b1 ERE in N2a resulting in transcription of Cyp26b1. 7) The learning and memory gene for prostaglandin E receptor 4, PTGER4, is also E6-AP and E2-dependent. 8) The learning and memory gene for the NPY receptor, NPY1R, is also E6-AP and E2-dependent.
Conclusions: We have identified 3 memory and learning genes that are transcriptionally regulated by E6-AP and E2-dependent: Cyp26b1, PTGER4, and NPY1R. This is evidence that these 3 genes may be altered in ASD, leading to learning and memory symptoms. Cyp26b1 is crucial to the levels of retinoic acid, which is important for neurodevelopment, in the brain. PTGER4 allows phosphorylation of glycogen synthase kinase 3 (GSK3). GSK3 has a large role in apoptosis and has been implicated in neuropsychiatric disorders such as Alzheimer's Disease and Bipolar Disorder. The NPY receptor functions in cell signaling, increasing calcium signaling and blocking adenylate cyclase. Further testing in rodent models will be necessary to confirm these promising findings and elucidate the molecular pathways for pharmacologic manipulation.

135 **163.135** Metabolic Profiling of the Children's Autism Metabolome Project (CAMP)

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Background:
ASD is a complex spectrum of neurodevelopmental disorders with heterogeneous underlying genetic, metabolic, and environmental causes. The CAMP (ClinicalTrials.gov Identifier NCT02548442) study, the largest clinical study using metabolomics based methodologies, is being conducted to validate biomarkers identified in three previous studies of banked blood samples and to better understand the metabolism of children with ASD. Metabolomic analyses of ASD may be useful in identifying biomarkers that can provide insight into the role that biochemical disorders, the gut microbiome, dietary and environmental factors play in ASD. The metabolic signatures of ASD can be useful in parsing the broad autistic spectrum into more homogeneous and clinically significant subtypes. Better understanding of metabolic subtypes or metabotypes of ASD can lead to early diagnosis, development and selection of more precise therapeutic intervention, as well as better understand of the efficacy of current interventions within metabotypes.
Objectives:
Conduct broad, discovery-based metabolomics profiling of CAMP subjects to reveal predictive metabolic signatures and discover metabolic subtypes of ASD. Identify metabotypes which can identify at least 50% of the ASD patient samples with a positive predictive value (PPV) of greater than 90%. Validate the metabolites identified as potential biomarkers of metabotypes of ASD in previous studies in the CAMP study.
Methods:
Plasma was obtained in sodium heparin tubes from children aged 18 to 48 months. Samples were analyzed using 4 orthogonal LC/HRMS-based methods as well as GC-MS to measure a broad range of metabolites through both targeted and non-targeted metabolomics methods. The patient samples were split into a training set of samples utilized for discovery profiling and a test set used for evaluation of the diagnostic signatures discovered in the training set. Univariate, multivariate and machine learning methods were applied to the training set to identify the most predictive set of metabolic features capable of classifying plasma samples as being from ASD or typically developing (TD) children. The molecular signatures were evaluated in the test set to determine their classification performance.
Results:
The metabolomics analysis of the 1500 CAMP subject samples is currently underway. In three separate clinical studies, comprising nearly 500 ASD and TD individuals, we demonstrated that metabolic profiling can be used to identify biomarkers associated with ASD as well as to elucidate metabotypes of ASD. These signatures contained both previously reported metabolic changes associated with ASD as well as novel, unreported changes. This poster will present results from the analysis of CAMP samples and potential of metabolites to discriminate ASD from non-ASD individuals.
Conclusions: Applying a paradigm such as this to identify metabolic signatures associated with ASD and elucidate their biochemical implications may be useful in developing diagnostic tests to detect ASD in children at an earlier age and for improving outcomes through personalized treatment. This approach will provide novel information on the biochemical mechanisms involved in ASD and the potential to identify targets for new therapies designed to treat the unique metabolic profile of the metabotype of the individual.

136 **163.136** Modeling Motor Neuron Deficits in a Family with Phelan-Mcdermid Syndrome and Autism Spectrum Disorder

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Background:
Several studies have found copy number variation (CNV) plays a role in autism spectrum disorder (ASD), especially rare CNV which has been found to carry larger effects than common variations.
Objectives:
This work aims to identify the pathological impact of ASD-related CNVs found only in the cases especially in a family with Phelan-Mcdermid Syndrome (PMS) and ASD harboring *SHANK3* deletion.
Methods:
First, we conducted a case-control association study in a sample of 335 individuals with a clinical diagnosis of ASD, confirmed by the Chinese version of the Autism Diagnostic Interview-Revised, and 1093 healthy controls after quality control checked. All the genetic samples of all the subjects were analyzed with Affymetrix SNP 6.0 for the CNVs. Second, after CNV discovery we conducted a gene expression analysis of lymphoblastoid cell lines (LCLs). Also, human motor neuron derived from induced pluripotent stem cells (hiPSCs) from patients with PMS and ASD are used as a cellular model of ASD.
Results:
Among the genes found only in the cases, 32 genes were reported to have the association with neuropsychiatric disorders. CNVs both duplication and deletion of genes may influence gene expression level in LCLs. The mRNA expression levels of 7 genes, *HDAC4*, *SND1*, *ABAT*, *SLC38A10*, *GNB1L*, *RPL10,* and *RAB39B,* were changed by CNVs in LCLs. Additionally, the oxygen consumption rate (OCR) is reduced in motor neurons derived from PMS-1 and PMS-2 patient ($P<0.001$ and $P<0.01$, respectively).
Conclusions:
Combining our recent publication (Yin et al., 2016) and this work, we suggest that case-only CNVs may play an essential role underlying the pathogenesis of ASD. Mitochondrial dysfunction may contribute to motor deficits in PMS and ASD.

137 **163.137** Novel Transcripts Identified from iPSC-Derived Cortical Neurons Generated from Individuals with Idiopathic Autism

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Background: Autism spectrum disorder (ASD) is a heterogeneous, neurodevelopmental condition characterized by irregularities in social interaction, verbal and non-verbal communication, and repetitive stereotyped behaviors. Understanding of ASD has been restricted by a lack of model systems that faithfully replicate all of the features of autism pathophysiology. Induced pluripotent stem cells (iPSCs) provide an attractive model to examine the cellular and molecular changes that underlie ASD. Previous RNA-seq analysis in our laboratory from cortical neurons derived from iPSC lines of individuals with idiopathic ASD and controls has identified sets of coding transcripts that are differentially expressed (DE). These results demonstrated an enrichment of DE genes in pathways including neuronal fate specification, extracellular matrix interactions, and axonal functionality. However, these coding RNAs represent only a small fraction of the total transcripts identified.
Objectives: The purpose of our current study is to identify novel transcripts, such as spliced isoforms and noncoding transcripts including long intergenic non-coding (LINC) RNAs, antisense transcripts, and circular RNAs that are differentially regulated in ASD-specific iPSC-derived cortical neurons compared to control neurons.
Methods: iPSC lines were created from peripheral blood mononuclear cells (PBMCs) and developed from a number of individuals with autism and controls. These iPSCs lines were differentiated into cortical neurons and RNA was extracted at several time points post initiation of differentiation (day 35, day 85 and day 135). RNA-seq analysis was performed using the HiSeq 2500 and significantly differentially expressed genes were identified at each of the time points using edgeR software. Further informatics analyses were used to identify novel spliced isoforms (eg. MapSplice) and noncoding transcripts (eg. lncrnadb.com and circbase.org) differentially expressed in ASD compared to control neurons.
Results: A wide variety of novel transcripts were identified that did not match the predominant coding RNAs, including alternatively spliced isoforms of coding genes and non-coding RNAs. Differential expression of alternative spliced isoforms that distinguish ASD and control neurons were identified at each time point. These can be categorized into different groupings such as missed exons, alternative exons, and retained introns. Noncoding transcripts were differentially expressed between the neurons from ASD and control neurons, including antisense RNAs (e.g. *DLGAP1-AS1* and *POU6F2-AS2*) and long intergenic noncoding RNAs (e.g. *LINC01139*). In addition, we were able to identify circular RNAs in our dataset. This included the well characterized *CDR1-AS*, also known as *ciRS-7*, a circular RNA highly expressed in the central nervous system that functions as a sponge for *miR-7* (Memczak, et. al., 2013, *Nature*).
Conclusions: The results of this study show that there is a diversity of transcripts that are differentially expressed in cortical neurons derived from ASD-specific and control iPSC lines. This enrichment for novel transcripts, particularly noncoding transcripts, suggests potential novel gene regulatory roles in ASD.

138 **163.138** Plasma Metabolome, PON1 Status, Environmental Exposures and Childhood Autism

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Background: Few studies have examined Autism Spectrum Disorder (ASD) and the interplay between genetics and environmental factors. The paraoxonase 1 (PON1) gene regulates the breakdown of organophosphate (OP) pesticides in the body and serves as an important antioxidant. PON1 levels may be affected by single nucleotide polymorphisms (SNPs), therefore individuals with certain PON1 SNPs plus environmental exposure during pregnancy may be at an increased risk for having a child with autism.
Objectives: The objective of this study was to examine a possible gene-environment interaction that focuses on prenatal environmental exposures and child metabolic vulnerability as a consequence of polymorphisms in the PON1 gene.
Methods: All children (n=400) in the present study including children with Autism Spectrum Disorder (ASD; n=200), and typically developed control children (TD; n=200) are part of a large ongoing population-based case-control CHARGE (CHildhood Autism Risk from Genetics and Environment) Study. Blood plasma metabolome profiles were obtained by Nuclear Magnetic Resonance (NMR) spectroscopy. Untargeted metabolomics analysis using Chemomx NMR Suite 8.1 was used to identify and quantify 69 metabolites in each sample including amino acids, organic acids, sugars and other compounds. Concentration of PON1 were determined by ELISA kits (Cloud Clone Corp), and paraoxonase activity was measured using commercially available assay kits (Molecular Probes Inc.). SNP data, and environmental exposure data was previously collected in the CHARGE Study.
Results: Children with ASD had higher levels of lactate, a metabolic waste product, and higher levels of the amino acids: alanine, serine, glycine, and tryptophan, consistent with mitochondrial dysfunction, and altered energy metabolism. In addition, ASD was associated with higher levels of uridine, a component of RNA previously reported to be inversely correlated with methylation capacity. Although we did not find a significant difference in the PON1 concentration and paraoxonase activity of children with ASD compared to controls, we did find that PON1 SNPs in coding and non-coding regions significantly affected its plasma concentrations. Moreover, there were a disproportionate number of children with ASD and specific PON1 SNPs that correlated with maternal organophosphate and pyrethroid exposures.
Conclusions: Â Our results add to the growing body of literature indicating autism is associated with an altered metabolic state compared to typically developed controls. These results suggest that maternal environmental exposures during pregnancy in combination with genetics may impact a child's metabolic outcome. Further studies are needed to understand how the metabolome affects neurodevelopmental outcome, or conversely if neurodevelopmental outcome affects the metabolome.

139 **163.139** Role of a Circadian-Relevant Gene, NR1D1, in Brain Development: Possible Involvement in the Pathophysiology of Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) is frequently accompanied by comorbid conditions, and associated with problems in the early developmental period including hyperactivity, panic, self-injury and sleep disturbance. Among them, sleep disruption such as insomnia or a short sleep cycle is one of the most common and distressed problems. In our previous study (Yang *et al*. 2015), we screened ASD patients with and without sleep disorders for mutations in the coding regions of circadian-relevant genes, and detected mutations in several clock genes including *NR1D1* (Nuclear receptor subfamily 1 group D member 1). Thus, circadian-relevant genes likely represent impaired molecular clock mechanisms that potentially contribute to the etiology of ASD. Meanwhile, *NR1D1* is located on 17q11.2, which was shown to be a region susceptible to ASD. As for the neuronal function, while synaptic activity induced the distribution of Nr1d1 to the spine and dendrite in wild-type mice, *Nr1d1*-knockout mice displayed abnormal behaviors such as marked hyperactivity, impaired response habituation in novel environments, deficient contextual memories and impairment in nest-building ability. The above observations raise the possibility that NR1D1 is crucial for synaptic functions and is a causal gene candidate for ASD and other neurodevelopmental disorders.
Objectives: We elucidated the role of Nr1d1 in the corticogenesis and contribution to ASD.
Methods: Sequence analyses of NR1D1 was done in ASD patients to detect mutation. And also, we performed *in vivo* analyses; *in situ* hybridization of Nr1d1 in developing mouse brain, and time-lapse imaging of migration of Nr1d1-deficient neurons.
Results: We identified three new substitutions, including a *de novo* heterozygous mutation, c.1499G>A (p.R500H) in ASD patients that was not detected in control individuals. We then examined the role of NR1D1 in the development of the mouse cerebral cortex. Acute knockdown of mouse *NR1D1* by *in utero* electroporation caused abnormal positioning of cortical neurons during corticogenesis. This aberrant phenotype was rescued by wild type NR1D1, but not by the c.1499G>A mutant. Time-lapse imaging revealed that the abnormal positioning was due to impaired migration. Moreover, knockdown of *NR1D1* also suppressed axon extension and dendritic arbor formation of cortical neurons, while the proliferation of neuronal progenitors and stem cells at the ventricular zone was not affected.
Conclusions: NR1D1 plays a pivotal role in corticogenesis via regulation of excitatory neuron migration and synaptic network formation, besides the role in circadian rhythm formation. Addition to the detection of *de novo* mutation in ASD patient, functional defects in NR1D1 suggested to relate to ASD pathophysiology.

140 **163.140** Salivary Oxytocin Levels in Young Children with Autism Spectrum Disorders (ASD) Compared to Healthy Controls

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Background: Evidences from literature in oxytocin, imply possible beneficial effect of oxytocin administration on social and communicative dysfunctions seen in ASD and their neural underpinnings. The lower levels of plasma oxytocin in ASD have been demonstrated in few studies in children and adolescents with ASD in comparison with typically developing children. Studies investigating salivary oxytocin levels in children with ASD have shown that oxytocin is lower in ASD than typically developing controls, rise in salivary oxytocin levels after social interaction and elevation of oxytocin levels in the saliva after intranasal administration thus influencing social cognition.
Objectives: This study attempted to 1) investigate the levels of oxytocin in the salivary samples of young children with ASD and compared with healthy controls and 2) the correlation of oxytocin levels to symptom severity scores measured by Childhood Autism Rating Scale (CARS).
Methods: 24 children diagnosed with ASD (mean age-4.6 years) and 18 age matched controls were recruited for the study. CARS was applied and severity scores were calculated for each subject with ASD. Saliva samples were collected using chewable cotton rolls. Samples were stored at -80 degree Celsius until further assay. Oxytocin levels were estimated by ELISA using commercial kits.
Results: Children with ASD had a mean salivary oxytocin level of 47.9706 µIU/mL. The mean oxytocin levels in the controls were 29.5866 µIU/mL. Between cases and control, cases had significantly higher oxytocin levels in the saliva – $p<0.009$. There was no significant correlation between symptom severity measures by CARS scores (Mean – 38.1) and oxytocin levels of children with ASD.
Conclusions: This study showed that children with ASD had higher levels of oxytocin compared to controls. There was no significant correlation between symptom severity and oxytocin levels. While most studies have shown lower levels of plasma and salivary oxytocin in children with ASD, few studies have shown no differences between the groups. However, this study showed higher levels of oxytocin in the ASD group which is unusual. Some notable differences from past studies are that, this study included 3 to 5 years old children with low functioning ASD. ELISA was done using the direct assay method. Saliva was not lyophilized during storage. Significant differences exist between values observed in similar populations and are likely due to methodological differences, ethnic variability, socio-economic differences; thus making comparison between studies difficult. In conclusion, use of saliva sample for oxytocin estimation in ASD and its role as a robust marker is debatable. Further studies to replicate and/or validate findings in similar samples are needed, in order to draw translatable evidence.

141 **163.141** Serum Metabolome Profile in GI Symptomatic ASD Children: A Pilot Study

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Background: We have previously shown that children with ASD and gastrointestinal (GI) inflammation display a unique gene expression profile both in GI biopsy tissue and peripheral blood, when compared to non-ASD GI-symptomatic children without GI inflammation. The differential gene expression patterns identified in peripheral blood can provide clues as to the pathobiology that underlies the inflammation and/or ASD. To explore this hypothesis further we have assayed serum from the same individuals to determine if the metabolite profiles: (1) also differ significantly between the groups and, (2) if they provide additional mechanistic insight.
Objectives: The goal of this study was to measure serum metabolite profiles in GI-symptomatic children with ASD and ileocolonic inflammation (ASD^{IC+}) and from GI-symptomatic typically developing children (without evidence of ileocolonic inflammation; TD^{IC-}), in order to compare metabolite levels between these groups.
Methods: Â Global metabolite profiles were determined in serum samples derived from 40 individuals as follows: (a) the "control" group (TD^{IC-}) consisting of 14 males and 5 females and, (b) the "case" group (ASD^{IC+}) consisting of 17 males and 4 females. Sample processing involved metabolite extraction, followed by ultrahigh performance liquid chromatography-tandem mass spectroscopy (UPLC-MS/MS). Raw data were extracted, peak-identified and QC processed. Compounds were identified by comparison to library entries of purified standards or recurrent unidentified entities. Following log transformation and imputation of missing values, if any, with the minimum observed value for each compound, Welch's two-sample t-test was used to identify biochemicals that achieved statistical significance ($p\leq0.05$), as well as those approaching significance ($0.05<p<0.01$).
Results: The present dataset comprises a total of 612 compounds of known identity (named biochemicals) measured in 40 individual serum samples. A comparison between the 2 groups showed that 292 metabolites (48%; 72 higher and 200 lower in ASD^{IC+} compared to controls) reached a level of statistical significance and another 36 metabolites (12 higher/24 lower in ASD^{IC+}) approached significance. Many of these metabolite level differences between ASD and TD samples have been reported in other studies, while some of the individual findings here are either in disagreement, or are altogether new, compared to published reports. Overall, the data showed that the two groups were distinguishable (i.e. significantly separated) by principal component analysis and the ASD^{IC+} profiles, as a group, appeared to be more heterogeneous. Using the primary groupings of "case" and "control", random forest analysis resulted in a predictive accuracy of 95% for the serum samples.
Conclusions: Comparison of metabolome profiles between ASD^{IC+} and TD^{IC-} showed that levels of nearly half of the serum metabolites are statistically significantly different between the two groups and that these metabolome profiles are largely phenotype-specific. Moreover, many of the specific metabolite level differences have previously been reported in metabolome studies comparing ASD and control samples, however in some cases the changes we found are either discordant or novel compared to published reports. This is not surprising since our pilot study examined differences in serum from children with ASD *and* gastrointestinal inflammation to serum from children with neither condition.

142 **163.142** The Children's' Autism Metabolome Project (CAMP): Anatomy of a Clinical Study Employing Metabolomics to Identify Novel Metabolic Subtypes of Autism Spectrum Disorder (ASD)

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Background:
ASD is a complex spectrum of neurodevelopmental disorders with heterogeneous underlying genetic, metabolic, and environmental causes. The CAMP (ClinicalTrials.gov Identifier NCT02548442) study, the largest clinical study using metabolomics based methodologies, is being conducted to validate biomarkers identified in three previous studies of banked blood samples and to better understand the metabolism of children with ASD. Metabolomic analyses of ASD may be useful in identifying biomarkers that can provide insight into the role that biochemical disorders, the gut microbiome, dietary and environmental factors play in ASD. The metabolic signatures of ASD can be useful in parsing the broad autistic spectrum into more homogeneous and clinically significant subtypes. Better understanding of metabolic subtypes or metabotypes of ASD can lead to early diagnosis, development and selection of more precise therapeutic intervention, as well as better understand of the efficacy of current interventions within metabotypes.
Objectives:
Enroll a total of 1500 subjects comprised of ASD, development delay (DD) and typically developing (TD) children ages 18-48 months. Employ a robust experimental platform based on orthogonal mass spectrometry methodologies comprised of both targeted and non-targeted metabolomics methods. Identify metabolic perturbations associated with ASD specifically focusing on the identification of metabotypes of ASD through measurement of metabolic differences in patients across the spectrum as compared to DD and TD children.
Methods:
The CAMP is being conducted at 8 locations. Diagnosis is based on DSM-V confirmed by Autism Diagnostic Observation Schedule (ADOS) for ASD and the Mullen scales of early learning for DD. Extensive data is being collected regarding medical history, diet, supplements and family history. Blood and urine samples are being collected for metabolomics and gene expression analysis. The numbers of patients for each group (ASD, TD or DD) were determined by a power analysis study, with the goal of providing a maximum power of 0.9 for pairwise comparisons in univariate and multivariate analyses.
Results:
The experimental platform developed for the CAMP study detects 2.2 times more metabolite related features then the previous results generated from the three smaller banked blood studies. The number of subjects allows for detection of novel, less prevalent metabotypes associated with ASD. The CAMP study metabolomics data will be analyzed in conjunction with cohort information, study demographic data, subject metadata, RNA expression and genotype information to better understand the metabolic profiles associated ASD.
Conclusions:
The CAMP study will provide the largest set of samples collected under procedures designed for metabolomics analysis. Metabolomics will provide a valuable additional perspective on this complex disorder. Collection of blood plasma and urine, as well as RNA and DNA, will allow an integrated evaluation of the metabolic phenotype of ASD. Better understanding of the metabolic phenotype of ASD has the potential to enable earlier diagnosis, identification of biochemical alterations in patients across the spectrum that will provide targets for new treatments as well as better understanding about who benefits from current treatments.

143 **163.143** The Role of Oxidative Stress in Adults with Autism Spectrum Disorders

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Background:
The diagnosis of autism spectrum disorders (ASDs) is currently based on observational and anamnestic data. Despite many years of research into the underlying neurobiology, the etiology of autism is still not fully understood. Oxidative stress could be a key player in the pathogenesis.
Objectives:
As previous studies have focused on children, it is still not known whether oxidative stress is a temporal finding or a persistent key-player in the pathophysiology in ASD. We therefore aimed to investigate the levels of the classical antioxidants superoxide dismutase 1 and 2 in adults with ASD.
Methods:
56 patients with a diagnosis of ASD, along with 56 age- and gender matched healthy controls, had their plasma analyzed for the antioxidants Copper/Zinc superoxide dismutase (SOD1) and Manganese superoxide dismutase (SOD 2) and filled out the autism quotient questionnaire (AQ).
Results:
Increased concentration of SOD1 was found among patients with ASD (268,2 vs. 205,6; p<0,0004), while no difference was found in SOD2 (85,06 vs. 76,21; p=0,5749). Patients with ASD scored higher on AQ (27 vs. 10; p<0,0001). When stratifying into AQ-score ≥ 32 vs. AQ-score < 32 no difference in SOD1 or SOD2 was found. There were baseline differences between case and control group, however none of them showed significant influence on either of the antioxidants.
Conclusions:
Patients with ASD showed higher concentrations of the antioxidant superoxide dismutase 1. This could be the result of an upregulation of the protein synthesis due to increased exposure to oxidative stress. This could be a possible future therapeutic target, although more studies are needed.

144 **163.144** Toward the Development of an ASD Biomarker: Altered Activity of Kinase Signaling Pathways in Blood

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Background: A high priority in autism spectrum disorder (ASD) research is the identification of a robust and reliable biomarker. Biomarkers can enable early detection and hence early intervention leading to better outcomes, and may help in the development and stratification of precision therapeutics. Recent progress in the genetics of ASD suggests that the signaling of two key kinase pathways, RAS-MAPK and AKT-PI3K, may be important to ASD pathogenesis. We previously demonstrated that the degree of activation of components of these Ras-MAPK and AKT-PI3K pathways as measured in the brain correlate with social behavior in an ASD-related mouse strain. We also demonstrated that the degree of this kinase activation in the brain correlated with that observed in lymphocytes. These findings motivated our current study, suggesting we can indirectly measure the state of activation of these signaling pathways in the brains of ASD patients and controls from measurements in peripheral blood.
Objectives: The aim of this study is to assess whether there is over and/or under activation of kinase signaling in children with ASD versus controls by using freshly isolated peripheral blood mononuclear cells (PBMCs) as a model. Our initial biopanel measures total expression and activity level (phosphorylated isoforms) of three groups of proteins, p44/42 MAPK (ERK1/2), PTEN and AKT (1-3)
Methods: A cohort of 57 idiopathic ASD children and 66 typically-developing control children (matched for age and gender) were enrolled, clinically assessed and had blood drawn. PBMCs were isolated from whole blood using Ficoll separation. After cell lysis the cytoplasmic fraction was used for Western Blot analysis. Total and phosphorylated form of ERK (ERK and p-ERK), PTEN (PTEN and p-PTEN) and AKT (AKT and p-AKT) were detected and quantified, corrected by Actin levels, and the ratios of the phospho to the total for each protein (p-ERK/ERK, p-AKT/AKT, and p-PTEN/PTEN) were calculated. These values were then z-scored using the mean and standard deviation across the entire cohort to measure the deviation of each individual from a standard value. The absolute value z-scored ratios were separately inserted into a generalized linear model (GLM) with group, age, gender, and gel set as independent variables. A statistically significant p-value ($p<0.05$) associated with the group coefficient was used to determine group differences.
Results: We found that the absolute value of the z-score for the p-ERK/ERK ratio is statistically significantly increased ($p<0.017$) as it is for the p-PTEN/PTEN ratio ($p<0.032$) in ASD children compared to controls, while we found a trend-level increase in p-AKT/AKT in our cohort ($p<0.19$). These comparisons were most significant through the use of |z-score|, demonstrating that both over and under activation of these pathways are found in ASD.
Conclusions: Our results show for the first time that steady state activation levels (both over and under) in the blood of key signaling pathways are significantly altered in idiopathic ASD children compared to controls. Our next steps are to understand how the degree of deviation can predict clinical severity and importantly how these and other measures can serve as a blood-based biomarker for ASD.

145 **163.145** Transcriptome Analysis of Neurons Differentiated from Patient-Specific Blood Derived Induced Pluripotent Stem Cells Reveals Convergent Pathobiology in Idiopathic Autism Spectrum Disorders

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Background:
To date, numerous candidate genes have been associated with autism spectrum disorder (ASD) with many of these genes known to have important roles in synaptic function and the development of neural circuits. This suggests that certain neurobiological processes could be commonly altered in ASD. Therefore, although there is a great deal of clinical and genetic heterogeneity in ASDs, there may be convergent deficits in key molecular mechanisms which underlie the disease. Nonetheless, Lack of appropriate human-based models of complex neurodevelopmental disorders has greatly hindered investigations of convergent neurobiology in ASDs. Hence, induced pluripotent stem cells (iPSCs) offer the opportunity to further unravel the complex biology underlying ASD.
Objectives:
This study aims to determine the convergent biological pathways underlying ASD by probing the transcriptome of cortical neurons derived from ASD-specific iPSCs.
Methods:
We derived patient-specific iPSCs from the whole blood of six individuals with idiopathic ASD and of five control individuals as well. Subsequently, each of these stem cell lines were differentiated into cortical neurons for 135 days. RNA was extracted from these neurons at day 35, 85 and 135 of differentiation and whole transcriptome analysis (RNA-Seq) was performed. Significantly differentially expressed genes were identified at each of the time points using edgeR software. Furthermore, gene networks and pathways were analyzed via multiple approaches: Ingenuity Pathway Analysis (IPA), Weighted Correlation Network Analysis (WGCNA), Short Time-series Expression Miner (STEM) and Gene Ontology (GO ontology).
Results:
Analysis of siginificantly differentially expressed genes at each time point highlighted deregulation in brain developmental, cytoskeletal and metabolic processes. Furthermore, analysis of overlapping differentially expressed genes between time points revealed five consistently differentially expressed genes at all three time points: FAR2P1, HS3ST4, MAB21L2, POTEF and TFF3. WGCNA analysis of the RNA Seq data generated a combined total of 52 gene modules and many of these modules presented an enrichment in the deregulation of pathways associated with neuronal differentiation, transcription and DNA and RNA metabolic processes. Finally, the analysis of changes in gene expression over time using the STEM software revealed neuronal cytoskeletal, proliferation and metabolic processes to be deregulated across the whole time course.
Conclusions:
In our study, different analytical approaches revealed multiple pathways and processes that have been previously reported to underlie ASD biology. These mainly consist of brain developmental, neuronal differentiation and cytoskeletal processes. Of particular note, we have found that DNA, RNA and other metabolic processes may be important contributors to ASD pathobiology. We have shown that patient-specific iPSCs can be used to model brain region-specific neuronal development permitting the identification of common molecular mechanisms disrupted in ASD and identifying important candidate targets for therapeutic intervention.

146 **163.146** Transcriptomic Modeling of Phelan-Mcdermid Syndrome Using Glutamatergic Neurons Generated from Patient iPSCs

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Background: Autism spectrum disorder (ASD) has high heritability and a prevalence of nearly 1% worldwide, but heterogeneity of patients has made identifying the underlying etiology difficult. By focusing on monogenic disorders with high penetrance for causing ASD, specific pathways might be identified that are common to a broader group of ASD patients with mechanistically related etiology. Phelan-McDermid syndrome (PMS) is one such ASD-associated syndrome that is caused by haploinsufficiency of the gene *SHANK3*, which encodes for a scaffolding protein of the post-synaptic density at glutamatergic synapses. While animal models provide great insight into pathways involved in PMS, induced pluripotent stem cells (iPSCs) generated from patient tissue samples retain the full genetic background of the individual and can be expanded extensively and differentiated into neural progenitor cells (NPCs) and neurons. Since it isn't possible to obtain brain tissue from living ASD patients, having a source of human neural cells in incredibly valuable.
Objectives: The overarching goal of this study is to improve our mechanistic understanding of PMS and identify candidate genes and pathways that can be targeted pharmacologically to alleviate neurological deficits of the syndrome. To accomplish this, we applied a multi-step approach that aimed to: 1) generate high-quality iPSC clones from PMS patients and siblings; 2) differentiate them into NPCs, followed by neurons, to capture the neurodevelopmental phenotype of PMS in patients; 3) identify PMS-associated differential gene expression in iPSC-derived neurons by RNA sequencing; and, 4) identify candidate drug targets and FDA-approved drug compounds for repositioning in PMS.
Methods: Blood samples from patients with PMS and unaffected siblings are collected for 14 PMS patient/sibling pairs and reprogrammed using a modified non-integrating Sendai virus to express reprogramming factors. For each individual, 2-3 clones are expanded for quality control (QC) and banking, and those that pass QC are differentiated into NPCs using a monolayer approach with PSC Neural Induction Media from Fisher. NPC lines are then transfected with doxycycline-inducible Ngn2 lentiviruses with puromycin selection and grown for 3 weeks to allow for maturation. RNA is isolated from NPC and neuron samples and subjected to RNA sequencing, and the PMS-associated changes in gene expression are then compared to known gene expression profiles of FDA-approved drugs and other ASD-associated syndromes.
Results: Twelve PMS patient/sibling pairs have been reprogrammed with 2-3 clones per individual having been used for NPC generation followed by neuronal induction. Initial NPC samples have been subjected to RNA sequencing for preliminary investigation into the early developmental transcriptional profile of PMS. Differentially expressed genes between PMS patient-derived NPCs compared to those from their healthy siblings were found to be enriched for components of the Wnt signaling pathway and were upregulated in the PMS-associated cells.
Conclusions: iPSCs from PMS patients offer a powerful tool for disease characterization, drug identification, and screening. Generating an expression profile for these patient-derived NPCs and neurons will provide a unique perspective on the transcriptional signature of PMS that can be used in conjunction with other models of the disease and known drug expression profiles to identify new therapeutics.

147 **163.147** Whole-Genome Methylation Screen Identifies Enriched Neuronal Pathways in a South African Autism Cohort

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Background:
An increasing number of studies support a role for epigenetic factors in the aetiology of autism. Recent work on monozygotic twin pairs, discordant for autism spectrum disorder (ASD) phenotype, implicated DNA methylation as a contributor to autism. Despite intense research over the past decade, no definitive biological markers for this disorder have been identified given the highly heterogeneous nature of ASD. This highlights the importance of a clearly defined ASD phenotype in molecular research.
Objectives:
We investigate whole-genome methylation patterns in a cohort of South African children. Differentially methylated regions are used to identify biologically relevant pathways. We validate selected genes within these pathways using quantitative methylation assays in both the discovery and replication cohorts.
Methods:
South African boys aged between 6-11 years old (n=32 ASD and n=16 controls) were recruited. All participants were assessed using the Autism Diagnostic Observation Schedule-2, ADOS-2. DNA was extracted from study participants using buccal cells. We performed a whole genome DNA methylation screen using Illumina 450K Human Methylation Array. Differentially methylated loci associated with ASD were used in gene ontology pathway analysis to investigate significant biological pathways. Selected genes from these pathways, both novel and previously associated with ASD, were validated using a quantitative mass spectrophotometry assay(Epityper®).
Results:
We identify over 5000 differentially methylated CPG sites (corrected FDR<0.5) associated with ASD. These sites are distributed across ~4000 different genes and UTRs. Gene ontology analysis identified Nervous System Development and System Development biological processes as being significantly enriched. When comparing ASD endophenotypes, with find significant associations with smaller gene sets. For example, children with severe Repetitive and Restricted behaviours, RRB (ADOS-2 score >8) show significant association for a smaller set of CpG sites across less than 100 genes, and thus we recover more targeted biological processes. We validate differential methylation quantitatively using mass spectrophotometry for two genes: a gene previously associated with ASD (SLC6A4) and a novel signalling gene. The quantitative data supports a role for differential methylation in ASD individuals with high social affect, SA (ADOS-2 SA>8) at both loci.
Conclusions:
This study is the first to investigate whole-epigenome profiles of DNA methylation in a South African cohort of children with ASD. We find that methylation patterns differ significantly between ASD and typically developing children at a large number of genes involved in biologically relevant processes, particularly in nervous system development. When looking at ASD subtypes, we are able to isolate smaller groups of CpG sites that display differential methylation, thus reducing the number of genes and processes involved. We have validated that differential methylation in signaling pathways is associated with ASD subtypes, which is consistent with the central role of neuronal signaling in neuropsychiatric disorders. Our approach of defining ASD subtypes in the search for molecular epigenetic markers is central to the identification of potential ASD biomarkers and effective drug targets.

148 **163.148** Maternal Factors Induces Autism-like Phenotypes in Mice

J. R. Huh*, Department of Medicine, Division of Infectious Diseases and Immunology, University of Massachusetts Medical School, Worcester, MA*

Background:
Â Human epidemiological studies point to a critical role for immune dysregulation in maternal womb as a risk factor in Autism Spectrum Disorder (ASD). This observation, coined maternal immune activation (MIA), has been modeled in mice by inducing inflammation in pregnant dams. However, The immune cell populations critical in the MIA model have not been identified
Objectives:
We tested whether inflammatory T helper cells producing interleukin-17 (Th17 cells) are necessary for MIA-associated phenotypes.
Methods:
We used both genetic mutants and blocking antibodies to investigate the roles of maternal Th17 cell pathway in promoting MIA associated phenotypes.
Â Results:
T cell-specific inactivation of RORγt in mothers (thus selectively removing Th17 cells in pregnant mothers) protected from induction of MIA-dependent behavioral phenotypes in offspring. In addition, we found that MIA leads to abnormal cortical phenotypes in offspring and this malformation is fully rescued by inhibiting the maternal Th17 cell pathway. We also showed that the receptor for IL-17 (IL-17Ra) is expressed in the developing fetal brain and its expression is increased in the cortex upon MIA.
Conclusions:
These observations collectively suggest a hypothesis that uncontrolled activation of IL-17Ra expressed in fetal brain induces abnormal cortical development and these structural abnormalities may be an underlying cause of the MIA-dependent autism-like phenotypes.

149 **163.149** Single-Cell Sequencing Reveals Microglia Population Vulnerability Following Maternal Immune Activation in Mice

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Background:
Maternal immune activation (MIA) during pregnancy has been linked to increased autism risk in offspring, but the mechanisms that lead to these changes are still largely unknown. Microglia, the resident immune cells in the brain colonize the brain during gestation, are highly sensitive to changes in the brain microenvironment and are altered in the brain's of some individuals with autism. This suggests that microglia could play a role in the disease manifestation and raises the intriguing possibility that their normal role guiding neural network formation during development could be disturbed.
Objectives:
MIA risk in humans and mice has been linked to the first two trimesters of pregnancy, a period when microglia are populating the brain and initiating their normal developmental programs. In order to understand whether and how MIA affects this developmental trajectory - as a whole or in small subsets of cells - we wanted to profile microglia during gestation and in young mice.
Methods: MIA was induced in pregnant mice using Poly I:C. We performed high throughput single cell sequencing (Drop-seq) of microglia at three developmental time points with and without Poly I:C exposure. We also performed immunohistochemistry on brains from littermates to identify different microglia subpopulations based on the markers identified by Drop-seq.
Results:
Based on the sequencing results of several thousand microglia per condition we found that microglia clustered into distinct subpopulations. These different subpopulations expressed markers of cell division, inflammation/phagocytosis, and cell motility. We found that exposure to Poly I:C changed the size of the phagocytic microglia group at the expense of the other subpopulations. These results persisted into early adolescence. Interestingly, this affected a relatively small subset of cells in specific brain regions.
Conclusions:
Our results are the first to create a detailed single cell sequencing map of microglia development in thousands of cells. This power gave us the resolution to detects small subpopulations of interesting microglia in different brain regions. Interestingly, MIA exposure shifted the number of cells occupying each of these states in a region specific manner, suggesting that certain microglia are more vulnerable than others to immune challenge. Further analysis will be needed to figure out potential mechanisms by which these subpopulations might affect neural network formation and behavior

Poster Session
164 - Sensory, Motor, and Repetitive Behaviors and Interests
5:00 PM - 6:30 PM - Golden Gate Ballroom

150 **164.150** A Comparison of Sensory Subtyping Models in Children with Autism Spectrum Disorder

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Background: Heterogeneity in sensory features in children with ASD is a barrier to the provision of customized and effective therapies (IACC, 2011). To date, two research groups have tested various subtyping models based on different parent-report measures and yielding different numbers of subtypes (range = 3-5 subtypes) across different cohorts (Ausderau et al, 2014; Lane et al, 2014; Lane et al, 2010; Lane et al, 2011).
Objectives: The aims of this study were: (1) test a 3-, 4- and 5-subtype model using the Short Sensory Profile (SSP) questionnaire with an independent and large national sample, and (2) compare the resulting classifications of children on the best-fitting SSP model to the established 4-subtype solution on the Sensory Experiences Questionnaire, version 3.0 (SEQ-3) (Ausderau et al., 2014) using a single cohort. From here, recommendations will be made for a unified model of sensory subtypes.
Methods: Extant data from the SEQ-3 and SSP were analyzed from participants with ASD (n=550), ages 2-12, as part of a national online survey. The SEQ-3.0 has 4 dimensional factors (i.e., hyporesponsiveness; HYPO, hyperresponsiveness; HYPER, sensory interests, repetitions, and seeking behavior; SIRS, and enhanced perception; EP); these factor scores were used in the subtyping analyses (Ausderau et al., 2014). For the SSP, we generated domain z scores (tactile sensitivity, taste/smell sensitivity, movement sensitivity, underresponsive/seeks sensation, auditory filtering, low energy/weak, visual/auditory sensitivity). Then, a latent profile analysis was conducted in MPLUS using the SSP z scores and relevant covariates; statistical fit indices (AIC, BIC, LMR, entropy, BLRT) were analyzed. The similarities and differences between the various subtype models and their theoretical underpinnings were qualitatively evaluated.
Results: Fit indices were mixed for 3-, 4-, and 5-subtype solutions, and we did not find conclusive support for a single subtype solution on the SSP, as was clear with the SEQ-3. The SEQ-3 subtypes included both high and low sensory severity subtypes, as well as two qualitatively different subtypes (one more hypo- and one more hyper-responsive). The SSP subtypes were strongly influenced by two domains: low energy/weak and movement, which are not well represented by items on the SEQ-3. A 3-subtype solution on the SSP was considered, but found to be theoretically less informative (i.e., followed a low, medium, high severity pattern, but no qualitative differences in patterns). The SSP 5-subtype solution showed good fit indices and was more consistent with Lane et al. (2011). Comparison of children's classifications across the two measures within the same cohort of 550 children is in progress.
Conclusions: This study is the first to subtype using two sensory measures within the same cohort of children. A unified model of sensory subtypes in ASD would have significant benefits to the field by clarifying latent constructs and providing guidelines for assessment and targeted interventions; however, theoretical models driving the development of these assessments impact how sensory features are characterized in ASD, and may contribute to inconsistencies in findings across studies. Clinical consensus on the role of various constructs (e.g., sensory modulation vs. motor/praxis) in characterizing sensory subtypes is recommended.

151 **164.151** Acoustic Design and Repetitive Behavior in Children with Autism

***S. Kanakri**, Ball State University, Fishers, IN*

Background: Emerging research in Evidence-Based Design for interiors is considering the unique sensory needs of users with autism spectrum disorders within built environments.
Objectives: The current study observes the impact of the acoustic environment on repetitive behavior in children with autism.
Methods: An observational study was conducted in four school classrooms for children with autism to observe changes in behavior associated with changes in the decibel levels in the room. 42 children, between the ages of 6-9 years old, diagnosed with high functioning autism were observed in classroom settings. Variant decibel levels in the classrooms and variance in the frequency of repetitive behaviors were measured to determine the strength and direction of the correlations between the two. Results were analyzed using Noldus Observer XT software.
Results: The repetitive behavior of children with autism is correlated with the acoustical condition of their environment
Conclusions:
These findings should be considered in the design of classrooms for children with ASD, for the benefit user comfort and educational performance.

152 **164.152** Age Differences in Objects Interesting Autistic Toddlers

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Background: Â It is well known thatÂ play and interest in objects mediate learning and that cognitive development in young typical children was notably rooted in solitary individuals' sensorimotor interactions with objects (Pellegrini et al., 2007; Piaget, 1983). However, little attention has been paid to young autistic children's use of objects in play situations. Generally, research on autism has focused on restricted interests or restricted use of toys (Klin et al., 2007; Taylor Bruckner & Yoder, 2007). The Montreal Stimulating Play Situation (MSPS; Jacques et al., 2011) is a semi-structured observation schedule where toddlers are exposed to various toys of potential interest to autistic children.
Objectives: To document age differences in autistic toddler's toy exploration while exposed to the MSPS.
Methods: Â 35 young autistic children (24-48 months, mean age = 38.46 months SD= 7.068, MSEL standard score: 63.7 ± 18.5) and 35 older autistic children (49-74 months, mean age = 58.63 months SD= 7.076, MSEL standard score: 68.0 ± 22.4) were exposed to the MSPS. The MSPS is composed of two periods of free play, a semi-free play period and a semi-structured play period and includes 34-40 objects. Object exploration was coded by two research assistants blind to the diagnosis using Observer (K=0.53). First, the Mann-Whitney U test was performed to evaluate the mean rank of the duration and frequency of object exploration in both groups. Then, the proportion of children exploring objects were compared across groups using the Fisher's exact test.
Results:
Three objects were significantly more explored in mean rank frequency and duration by younger children (sound blocks, miniature cars, magnetic letters & numbers, all *p*'s<.05) and one object was significantly more explored in mean rank frequency (visual and sound train, *p*<.05). A marginally higher proportion of younger children explored the visual and sound train (82.9% vs. 60.0%, *p*=0.06) and the sound blocks (71.4% vs. 45.7%, *p*=.05).
Two objects were significantly more explored in mean rank frequency and duration by older children (books and balloons, all p's<.05), while the wheel caterpillar was more explored only in mean rank frequency (*p*<.05). The remote controlled car was marginally more frequently explored (*p*=.06) and this exploration was lasted longer (*p*<.001). A significantly higher proportion of older children explored the books (57.1% vs. 25.7%, *p*< .05).
Conclusions: Â Younger autistic children seem to explore toys which are designed for lower developmental levels and older autistic children explored toys which are designed for higher developmental levels. However, younger autistic children already show an interest for letters and numbers, which is congruent with research showing the precocity of literacy interest in autism (Newman et al., 2007).

153 **164.153** An Analysis of Eating Postures in Adolescents and Young Adults Diagnosed with Autism

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Background: Our study sought to look at eating posture in individuals with autism. Most of the studies in autism related to eating are concerning behavior.[1-8] One systematic review looked at interventions to improve eating, but postural analysis was not included.[9] A few studies addressed certain components of motor behavior, posture, and techniques. Brisson et al.[10] performed a retrospective study of infants who were later diagnosed with autism, and found that they demonstrated less anticipatory mouth opening when presented with a spoon than the control group; 4-6 months appeared to be the key period to recognize this delay. Studies with children with autism found that using a flipped spoon improves not only eating behavior, but oral motor processing.[11,12] In addition van den Engel-Hoek et al.[13] analyzed the acquisition of assisted spoon feeding and provided additional data on the components. A cornerstone to understanding how prehension relates to spoon-feeding was supported in the research by Churchill et al.[14] who demonstrated that reaching/grasping and spoon-feeding demonstrate similar kinematics in healthy adult subjects. David et al.[15] sought to identify impairments in precision grip in children and adolescents with high-functioning autism. They found temporal dyscoordination and greater variability in precision grip when the subjects were compared to a group of typically developing age-matched peers. Memari et al.[16] proposed that additional studies are necessary to discern the exact cause and differences in postures between individuals with and without autism. This premise was corroborated in a study assessing individuals with autism with and without speech delay and controls, as they found difference in motor skills.[17]
Objectives: The purpose of this study was to analyze eating postures in a group of individuals with autism spectrum disorders (ASD) who demonstrate expressive language impairment (ELI), and compare their eating postures to a group of age-matched peers. While eating behaviors and techniques have been studied in the autism population,[1-8] to date no research has been generated on the postures of individuals during eating. It was hypothesized that individuals with ELI-ASD would demonstrate different postures and strategies.
Methods: Nine subjects with ELI-ASD (age range 16-22 year; 1 female and 8 males) were recruited for this study. The Childhood Autism Rating Scale (CARS) was used to assess level of autism with all demonstrating "severe autism" with a a mean total score of 51.11 (SD5.54) with significant language impairment. Ten age-matched controls (18-20 year of age; 3 females and 7 males) were also recruited. During the discrete eating events each subject was video taped. Utlilizing a rubric and biomechanical analysis the following data was processed: attention to eating, hand used to hold spoon, grasp, spoon position, trunk posture, and other related movements.
Results: Initial data analysis found significant differences between the ELI-ASD group and the control in eating including attention, grasp, and posture. Additional analysis is ongoing at this time.
Conclusions: Individuals with ELI-ASD demonstrated significantly different eating postures compared to the control group. This new line of analysis provides opportunities for intervention to ameliorate postural deficits, and improve life for individuals with autism in the realm of activities of daily living.

154 **164.154** Auditory Temporal Perception Is Enhanced in Children with ASD

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Background: Pitch and time are two fundamental dimensions of auditory perception. In Autism Spectrum Disorders (ASD), enhanced pitch perception has been reported (Bonnel, 2010), providing support for an auditory basis for the enhanced perceptual functioning (EPF) model of ASD (Mottron, 2006). However, the temporal resolution of auditory perception in ASD has been less studied. Here, we developed a task that allows testing the accuracy of both pitch and time judgments using analogous stimuli within the same participants.
Objectives: The aim of this study was to compare accuracy of fine-grained auditory pitch and time judgments between children with ASD and typically developing (TD) controls.
Methods: Participants were 36 ASD and 27 TD children from the NeuroDevNet project (Zwaigenbaum et al, 2011). Groups were age-matched (mean 12.5 years, range 7-17) and had IQ>70. ASD participants were diagnosed using ADI-R and ADOS. In the Pitch-Time task, reference stimuli consisted of 5 harmonically complex tones (3 harmonics) at 500 Hz, each 100 ms in duration, with an onset-to-onset interval of 350 ms. Participants judged whether the 5 tones were the “same” (reference stimuli) or “different” (pitch or time manipulation). In the Pitch condition, half of the trials had the 4th tone changed in pitch by up to 300 cents. In the Time condition, half of the trials had the 4th tone shifted in time by up to 200 ms. Pitch and Time conditions were presented in separate counterbalanced blocks. Accuracy (percent correct) on the task was calculated by splitting the “different” levels into 4 bins of interest having center values of 3.1, 9.4, 18.8 and 37.5 cents (Pitch), and 14, 35, 49 and 63 ms (Time). Effects of group and level on accuracy were assessed for each condition via ANOVA, and per-level comparisons were made using Student’s t-test with Bonferroni correction across the 4 bins ($p < .0125$).
Results: Â Participants with ASD were more accurate overall compared to the TD group on the Time condition ($F(1,38.9)=5.7$, $p=.02$; Figure 1). Accuracy varied across time levels in both groups ($F(3,106.5)=91.7$, $p<.001$). The greatest group difference was at the 35 ms Time level ($t(23.7)=3.1$, $p=.006$, 95% confidence interval 3.9%-20.2%). In the Pitch condition, accuracy varied significantly across pitch levels ($F(3,142.5)=132.4$, $p<.001$), but there was no group difference on the overall score or for any pitch level (all $p>.15$; Figure 2).
Conclusions: The results provide new evidence for enhanced auditory perception in the time domain in ASD. Accuracy of temporal judgments was greater overall in the ASD group, and this effect was most pronounced for judgments of time manipulations around 35 ms. This enhancement is consistent with and extends our understanding of low-level perceptual advantages under the EPF model in ASD. Further, the study of auditory perception in ASD serves as a complementary lens to more symptom-based studies, and helps to better understand individual differences in ASD.

155 **164.155** Biofeedback-Based Balance Training in Autism Spectrum Disorder

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Background: Many individuals with autism spectrum disorder (ASD) have difficulties with postural control (for review, see Memari et al., 2014). These postural control difficulties appear to be related to core autism symptom severity (Radonovich et al., 2013; Travers et al., 2013) and may affect adaptive daily living skills, such as dressing and driving. However, there is little published data on whether postural control can be enhanced in ASD through intensive balance training. Examining how balance in ASD changes as a function of training may shed light on the underlying mechanisms involved in poor postural control in ASD and would reveal who on the spectrum may benefit most from this type of training.
Objectives: 1) To examine if substantial balance improvements in ASD can result from a 6-week biofeedback-based balance training, and 2) to examine individual differences in age, cognition, and symptom severity that moderate the effectiveness of the training.
Methods: Twenty-two children and adolescents with ASD (1 female; ages 7-17 years) completed 6 weeks (18 sessions) of biofeedback-based balance training administered through an in-house video game. Each session lasted 60 minutes and consisted of participants playing our *Ninja Training* game that was developed to promote static balance, using a Kinect camera- and Wii balance board. In this game, each participant viewed him/herself on the screen and was asked to match his/her body to a shadow that portrayed one of six desired balance poses. Participants were rewarded for holding the pose as long as possible. We measured the total length of time that the participant was able to correctly hold each pose. Linear mixed-effects models examined balance-related changes over the course of the 18 training sessions in ASD. Pearson R correlations examined whether individual differences in IQ or symptom severity (SRS and RBS-R) were related to balance training outcomes.
Results: Over the 18 sessions of balance training, participants on average increased their balance times by ~2 seconds each session, exhibiting significant gains for both two-footed, β = 2.25, *SE* = .50, $p < .001$, and one-footed standing poses, β = 1.97, *SE* = .58, $p < .001$. Higher performance IQ (but not verbal IQ) related to longer starting balance times, $r = .50$ $p = .02$, and enhanced training-related gains, $r = .41$ $p < .05$. Less severe ritualistic behaviors (but not SRS or other RBS-R domains) related to enhanced training-related gains, $r = -.55$, $p = .008$. Age was not significantly related to starting balance times nor training-related gains (all *p*'s >.08), although the effect sizes were medium (*r*'s from -.36 to -0.38).
Conclusions: Overall, participants exhibited balance improvements, supporting that balance challenges in ASD can be targeted using biofeedback-based balance training. Surprisingly, age was not a strong predictor of training-related changes. However, individuals with ASD who had higher performance IQs and less frequent ritualistic behaviors demonstrated the largest improvements in balance. These data, while preliminary, shed light on why some individuals with ASD may have more persistent difficulties with balance than others.

156 **164.156** Can Timing Tasks Successfully Differentiate Children with ASD from Those with SLI?

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Background: A perinatal disruption in cerebellar development has been proposed to be a direct cause of autism (ASD; Wang, Kloth, & Badura, 2014). Adults with cerebellar lesions exhibit timing deficits, as indicated by increased timing variability on a finger tapping task (Schlerf, Spencer, Zelaznik, & Ivry, 2007). Much like children with ASD, children with specific language impairment (SLI) show deficits in language and motor development. However, discrete timing is not implicated, because children with SLI do not show deficits in variability during single-effector timing tasks (Zelaznik & Goffman, 2010). Timing tasks that involve coordination of multiple effectors (e.g., clapping) are impaired in SLI (Vuolo, Goffman, & Zelaznik, accepted). Because of the overlap in symptoms, there has been some debate as to whether ASD and SLI are distinct developmental disorders (e.g., Bishop, 2010). We predicted that timing tasks, such as tapping and clapping, might be able to differentiate children with ASD from those with SLI.
Objectives: The goal of our study was to determine whether children with ASD perform more similarly to an individual with cerebellar dysfunction or SLI on timing tasks with one and two-effectors. If children with ASD show impaired single-effector timing, the results would support the hypothesis of cerebellar dysfunction in children with ASD. If children with ASD do not show impaired single-effector timing, but do show bimanual (multi-effector) coordination difficulties on timing, then the results would indicate that ASD is more similar to SLI.
Methods: Eleven children with ASD and 6 age-matched children with SLI (to date) participated in a tapping and a clapping task. Hand movements were recorded. Participants were trained to tap and clap to a 600 ms tone presented by a metronome, and to continue tapping and clapping at the same rate for 32 continuation intervals after the metronome disengaged. Six trials were completed for each task. The within-trial, within-participant variability (CV%) of the interval durations was calculated to provide a measure of timing precision. All children also completed the Movement Assessment Battery for Children – Second Edition to index general gross and fine motor skills.
Results: (Preliminary 11 ASD, 4 SLI) The children with ASD (*M* = 13.29 CV%, *SD* = 8.57) were more variable than their peers with SLI (*M* = 10.83 CV%, *SD* = 3.96) on the single-effector, finger tapping task, but equally variable on the multi-effector clapping task (ASD, *M* = 15.30 CV%, *SD* = 6.21; SLI, *M* = 15.00 CV%, *SD* = 6.07). The children with ASD also performed more poorly on the standardized test of gross and fine motor skills (*M* = 4.73, *SD* = 2.49) than their peers with SLI (*M* = 8.57, *SD* = 2.22).
Conclusions: Â Unlike children with SLI, children with ASD exhibited a decrement in timing precision on the single-effector timing task. This finding lends support to the cerebellar sensitive period hypothesis of ASD put forth by Wang and colleagues (2014). It also highlights the role of timing tasks, and potentially fine and gross motor tasks, in differentiating children with ASD from those with SLI.

157 **164.157** Caregiver Strain Varies By Sensory Subtypes of Children with Autism

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Background: Caregivers of children with autism spectrum disorder (ASD) have higher levels of strain than caregivers of children with attention-deficit/hyperactivity disorder, developmental disabilities, or other healthcare needs (Cadman et al., 2012; Dabrowska & Pisula, 2010; Estes et al., 2009). High caregiver strain has been associated with poorer quality of life of the caregiver and negative health behaviors including: decreased physical activity; poor sleep patterns; difficulties with weight maintenance; smoking; and alcohol consumption (Rizk, Pizur-Barnekow, & Darragh, 2014; Gallant & Connell, 1998). Level of strain experienced by caregivers of children with ASD has been shown to be a function of many parent and child characteristics, including the child's difficulty with reacting to everyday environmental sensory stimuli (Kirby, White, & Baranek, 2015; Schaaf, Toth-Cohen, Johnson, Outten, & Benevides, 2011). Recently, researchers have proposed a classification schema for children with ASD based on shared patterns of sensory difficulties that groups children into one of four sensory subtypes using parent responses to the Short Sensory Profile: Sensory Adaptive; Taste/Smell Sensitive; Postural Inattentive; and Generalized Sensory Difference (Lane et al., 2014). As these subtypes have been documented to differ on many behavioral characteristics, it is reasonable to hypothesize that caregivers of children in different subtypes may differ in level of perceived strain (Lane et al., 2010, 2011, 2014). Therefore, sensory subtyping may be a useful mechanism for determining which caregivers of children with ASD may be at risk for the highest levels of strain.
Objectives: We sought to examine the relationship between child sensory subtype and the level of strain reported by the caregiver.
Methods: This study used a non-experimental, cross-sectional design to conduct an online survey of caregivers of children with ASD (n=367). The primary variables of interest were child sensory subtype, as measured by the Short Sensory Profile (McIntosh et al., 1999), and caregiver strain, as measured by the Caregiver Strain Questionnaire (Brannan et al., 1997). Caregiver age, child age, household income, and number of children in the home were included as covariates. A canonical correlation analysis was conducted to examine the relationship between child sensory subtype and caregiver strain.
Results: Caregiver strain was significantly associated with the child's sensory subtype membership, while controlling for demographic variables. Caregivers of children in the Sensory Adaptive subtype reported the lowest levels of caregiver strain, followed by caregivers of children in the Taste/Smell Sensitive subtype. Caregivers of children in the Postural Inattentive and Generalized Sensory Difference subtypes reported the highest levels of strain.
Conclusions: This study demonstrates that strain of caregivers of children with ASD is associated with the child's sensory subtype. Findings from studies using qualitative methods suggest possible mechanisms by which caregiver strain is related to child sensory subtype membership; behaviors consistent with those observed in children in the Postural Inattentive and Generalized Sensory Difference subtypes, for example, were reported to result in disruption of family routines and social activities (Schaaf et al., 2011), which may explain why caregivers of children in these subtypes report the highest levels of strain.

158 **164.158** Characterising the Relationship Between Anxiety, Executive Function, and Restricted and Repetitive Behaviours in Children and Adolescents with Autism Spectrum Disorder

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Background: Kanner (1943) first hypothesised that anxiety may underlie restrictive and repetitive behaviours (RRBs) observed in children with Autism Spectrum Disorder (ASD), serving as a maladaptive coping mechanism (Rimland, 1964). RRBs may also be associated with poor executive functions (EF), such as poor impulse control, and inflexibility to shift between different tasks (Turner, 1997). However, little is known about the underlying relationship of anxiety with EF and RRBs in children and adolescents with ASD. Better understanding anxiety and EF's roles in RRBs may inform the development of evidence-based treatments to help reduce RRBs.
Objectives: To characterise the relationship between anxiety, EF (impulse control and flexibility), and RRBs in children and adolescents with ASD, and explore possible mediators of RRBs.
Methods: Participants included 41 high-functioning children and adolescents with ASD between the ages of 5 and 17 years (male = 20, female = 21; IQ Mean = 102.24, SD = 19.03; range 74 to 167). Parents completed all behavioural measures. Anxiety subscale of Child and Adolescent Symptom Inventory – 5 (CASI-5) (Sukhodolsky et al., 2007) measured anxiety. The Inhibition and Shift subscales of Behavior Rating Inventory of Executive Function (BRIEF) measured impulse control and flexibility respectively. Repetitive Behavioral Scales-Revised (RBS-R) measured RRBs. First, Pearson's correlation evaluated the relationship between anxiety, flexibility, impulse control, and RRBs. Next, hierarchical linear regression further partitioned the variance associated with anxiety and EF in predicting RRBs. Finally, mediation analyses evaluated possible mediating roles of flexibility and impulse control on the relationship between symptom severity of co-occurring anxiety, and RRBs. Age was controlled in all analyses.
Results: We found significant positive correlation between anxiety (CASI-5 raw) and RRBs (RBS-R total raw) (r =.57, p <.001). Greater difficulties in both impulse control (BRIEF-Inhibit raw), and flexibility (BRIEF-Shift raw) were associated with heightened anxiety (r =.46, p <.01; r =.48, p <.01; respectively), and greater RRBs (r =.64, p <.001; r =.78, p<.001; respectively). Hierarchical Linear regression model (Table 1) showed that flexibility accounted for a significant portion of the variance associated with RRBs, R^2 =.55, F (1,38) = 34.18, p <.001. Adding impulse control did not increase the overall model's ability to account for variances associated with overall RRBs. Adding anxiety accounted for additional variance associated with RRBs, R^2 change =.04, p <.05, and significantly improved model's ability to account for variances associated with RRBs, F change (1,36) = 4.18, p <.05. Mediation analyses revealed that flexibility, and not impulse control, partially mediated the relationship between anxiety and use of RRBs (Figure 1), *Sobel's Z* = 2.93, p<.01. Anxiety did not mediate the relationship between flexibility and RRBs.
Conclusions: Results indicate that children and adolescents with ASD who experience greater levels of anxiety display more RRBs, which was partially mediated by poor flexibility and set-shifting. One clinical implication may be that simultaneously targeting symptoms of anxiety and improving flexibility may help reduce RRBs in young people with ASD. Future research can determine whether findings may hold in a lower-functioning sample, and investigate gender differences.

159 **164.159** Characterization and Clinical Impact of Repetitive Compulsive Behaviors in a Cohort of Psychiatrically Hospitalized Children with ASD

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Background: Repetitive compulsive behaviors (RCBs), including stereotypies, self-injurious behaviors and compulsions, are a key clinical feature of autism spectrum disorder (ASD). Diverse RCBs have been reported for patients with different levels of IQ and verbal abilities, but scarce data are available for behaviorally dysregulated patients with ASD requiring hospitalization for acute stabilization.
Objectives: This study aims to characterize RCBs and assess their clinical impact for a sample of youth with ASD hospitalized due to acute behaviors and/or co-morbid psychiatric conditions.
Methods: Youth aged 4-20 years, with an ADOS-confirmed ASD and admitted to a specialized inpatient psychiatry unit, were prospectively enrolled in a six-site study examining patient phenotypes, including RCBs, as part of the Autism Inpatient Collection (AIC). Data regarding the occurrence and nature of RCBs, length of hospital stay, parent stress, and patient community-reported sleep were collected. Caregivers also reported on the following measures at admission: Social Communication Questionnaire (SCQ), Aberrant Behavior Checklist-Community (ABC-C), Self-Injury Subscale of the Repetitive Behaviors Scale-Revised (RBS-R), and the Parent Stress Index-4 –Short Form (PSI-4-SF). They also answered direct questions about patient sleep problems at home, including quality of sleep, awakenings and problems falling asleep. Questions that reflect RCBs from the SCQ (7 items), ABC-C (10 items) and RBS-R (8 items) were chosen and compiled to generate an RCBs composite. Linear regressions estimated the effect of the RCB composite on each of the following outcomes: length of hospital stay, community sleep indicators and parental stress, while controlling for confounders.
Results: Data from 164 patients with ASD who were hospitalized and had complete survey data were analyzed. The mean patient age was 12.8 years (*SD*=3.22). The sample was 23% female and 87% Caucasian. The RCB composite score was significantly associated with higher parental stress level (p=0.002), poor sleep in the community (p=0.01), more frequent awakenings in the community (p=0.04) and longer length of stay (p=0.007). RCB composite scores were then adjusted for IQ and parental income as appropriate, with results continuing to be significant for parental stress (p=0.001), poor community sleep (p=0.02), difficulty falling asleep in the community (p=0.02), and length of stay (p=0.05).
Conclusions: Â RCBs are common and problematic among psychiatrically hospitalized youth with ASD. Results show that RCBs were correlated with clinical outcomes including dysregulated sleep patterns, longer hospitalizations and greater parental stress. These results are independent of the patient's IQ and parental income level, suggesting that RCBs could be a specific target for intervention to improve overall outcome. While causal connections between RCBs sleep patterns are not yet evident, future research could investigate neurobiological connections between these two clinical phenomena.

160 **164.160** Characterizing Restricted and Repetitive Behavior Expression in Minimally Verbal Children and Young Adults with ASD Using Direct Observation and Parent Report

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Background:
Despite increasing efforts to investigate restricted and repetitive behaviors (RRBs) as one of two core symptoms of autism spectrum disorder (ASD), little is known about their expression in minimally verbal (MV) individuals. Previous research quantifying RRBs in MV individuals with ASD used parent report to supplement routine observations taken during diagnostic testing, but there have been no systematic analyses of RRBs observed during a semi-structured clinical assessment compared with parent report.
Objectives:
First, to quantify the expression of RRBs in MV children and adolescents with ASD using direct observation methods and to compare those results to parent report and, second, to examine the relations been RRBs and age, nonverbal IQ (NVIQ), and receptive vocabulary.
Methods:
Participants
40 individuals, aged 5;3-20;10 years (M=10;5 years), with limited expressive language abilities and a diagnosis of ASD.
Direct Observation
Two raters independently coded ADOS-2 and Adapted ADOS videos for the frequency of RRBs (Kappa=0.81), using a coding scheme based on Repetitive Sensory Motor (RSM) and Insistence on Sameness (IS) subcategories (Bishop et al., 2013) and operational definitions similar to those from the Autism Diagnostic Interview-Revised (ADI-R) and the Repetitive Behavior Scale-Revised (RBS-R). Because administration duration of the ADOS varied across participant (range=45-60 minutes), the frequency of RRBs was translated into rate-per minute of RRBs.
Parent Report
Parents reported the current frequency and intensity of participants' RRBs on the ADI-R and RBS-R. Table 1 shows the percentage of participants who exhibited one or more of the specific RRBs according to parent report.
Other Assessments
The Leiter-3 and Peabody Picture Vocabulary Test (PPVT-4) were administered to assess NVIQ and receptive vocabulary, respectively.
Results:
Almost all participants (97.5%) expressed one or more RSM behavior during the ADOS administration, consistent with parent report. However, only 20% expressed one or more IS behaviors during the ADOS, compared to higher proportions of parent-reported IS behaviors, in daily activities (Table 1).
Observed RSM behaviors were positively correlated with parent-reported RSM behaviors on the ADI-R ($r_s(38)=0.33$, $p=.04$), but were negatively correlated with NVIQ raw scores ($r_s(38)=-.49$, $p=.001$) and PPVT-4 raw scores ($r_s(38)=-0.53$, $p=.00$). There were no correlations between observed RSM behaviors and age, parent-surveyed RSM behaviors (RBS-R), or between any observed or parent reported IS behaviors (Table 2).
Conclusions:
RSM behaviors expressed by MV individuals with ASD are salient enough to be observed in a brief, semi-structured lab setting as well as in the daily activities parents observe. However, format of parent report and method of completion (i.e., interview vs. self-completed questionnaire) could influence correlational results between lab observations and parent report. The lack of correlations between observed and parent-reported IS behaviors are likely a result of their relatively low frequency in a novel laboratory environment.
In addition, the negative correlation between RSM behaviors and receptive word knowledge suggests the need for language and communication interventions to supplement standard behavioral interventions in this population.
References:
Bishop et al. (2013) Subcategories of restricted and repetitive behaviors in children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 43*(6), 1287-1297.

161 **164.161** Comparing Severity of Restricted and Repetitive Behaviors Between High Risk Baby Siblings with Different Temperament Profiles

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Background:
Early self-regulatory behavior is a key component of temperament (Rothbart, Posner, & Kieras, 2006). High risk baby siblings with ASD demonstrate early signs of repetitive behaviors, as well as difficulties with self or other regulation (Bryson et al., 2007). Poor behavior regulation also predicts repetitive behaviors in high functioning school-aged children with ASD (Boyd, et al., 2009). The current study further explores the relationship between early behavior regulation and repetitive behaviors in high risk baby siblings who screened positive for ASD.
Objectives:
To compare severity of restricted and repetitive behaviors (RRBs) in high risk baby siblings with distinctive temperament profiles at age 2.
Methods:
Baby siblings of children with ASD were screened for autism using the M-CHAT(-R) at age 2. Parents of children who screened positive completed the Toddler Temperament Scale (TTS) and Repetitive Behavior Scale – Revised (RBS-R) during a diagnostic evaluation. Mean scores on the Activity, Rhythmicity, Approach, and Distractibility subscales of the TTS (with acceptable internal reliability; i.e., Cronbach's $\alpha \geq 7$; Chen, Barton & Fein, 2016) were dichotomized to contrast the top quartile against the remainder, and entered into a latent class analysis. Model fit indicators suggested a two-class solution as the best model. The two latent classes were subsequently labeled *Poorly Regulated and Attuned* (PRA) and *Well Regulated and Attuned* (WRA; see Figure 1). The PRA group was relatively more likely to endorse high activity, arrhythmicity, and poor approach, and less likely to endorse high distractibility. Chi-square tests were used to compare demographics between the PRA (n = 87) and WRA (n = 40) groups. Logarithmic or square root transformations of RBS-R Total and subscale scores were performed to address skewness in the data. Diagnostic group (ASD, non-ASD) was entered into a hierarchical linear regression before entering the dummy-coded latent classes as predictors of RBS-R scores.
Results:
Chi-square tests indicated no significant differences in age or gender between the PRA and WRA groups. The PRA group had a significantly higher proportion of baby siblings diagnosed with ASD. Logarithmic transformations of the RBS-R Total, Stereotyped Behavior, and Sameness Behavior scores successfully addressed data skewness. Transformations of the other domain scores were unsuccessful due to severe positive skew. Linear regression results indicate a significant improvement in variance predicted by temperament latent class above variance predicted by diagnostic group alone for RBS-R Total Score ($p < .001$, $\Delta R^2 = .118$), Stereotyped Behavior ($p < .001$, $\Delta R^2 = .100$), and Sameness Behavior ($p < .001$, $\Delta R^2 = .083$).
Conclusions:
High risk baby siblings who screen positive for ASD at age 2, and who demonstrate different temperament profiles in early patterns of behavioral regulation and attunement to others, differ significantly in the severity of their RRB symptoms. More severe RRBs were associated with high activity, poor rhythmicity, poor approach, but less distractibility, suggesting that perseverative attention may contribute to RRBs. These differences exist above and beyond having a diagnosis of ASD. Early regulatory behaviors may provide important information about ability to regulate maladaptive repetitive behaviors.

162 **164.162** Comparing fNIRS-Based Cortical Activation Patterns Between Children with and without Autism, during Bilateral Coordination Tasks

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Background: Impairments in motor coordination are often reported in children with Autism Spectrum Disorder (ASD). For example, children with ASD have difficulties with upper-limb, bilateral, and/or visuo-motor coordination using various standardized measures (Bhat, Landa, & Galloway, 2011; Jansiewicz et al., 2006). In the current study, we implemented a novel neuroimaging tool called functional near-infrared spectroscopy (fNIRS) to study the sensori-motor patterns of children with and without ASD during a drumming task.
Objectives: We compared fNIRS-based cortication activation in frontal, parietal, and temporal cortices during drumming between children with and without ASD as well as healthy adults.
Methods: 12 children with and without ASD between 6 and 12 years of age and 12 healthy adults were seated with a tubano drum. The task involved drumming in 3 ways (Srinivasan et al., 2015): a) *Unilateral*: the child hit the drum with one hand only, b) *Alternating*: *the* child hit the drum with both hands alternately, and c) *Complex*: the child hit the drum using a complex quarter-eighth pattern (1:2). 24 trials were collected, 8 per condition using a randomized block design. The oxy hemoglobin response of the fNIRS signal was further analyzed to study differences in activation patterns between tasks, between hemispheres, and between the regions of interest (primary motor, primary somatosensory, auditory).
Results: Our preliminary data suggest that complex drumming led to highest level of cortical activation compared to alternating or unilateral patterns. We also found hemispheric differences depending on the nature of the task. The hemispheric differences were primarily seen in the sensori-motor regions.
Conclusions: We noticed variations in cortical activation patterns based on tasks, hemispheres, and regions. We believe these findings could be used to explain the cortical abnormalities contributing to the motor issues observed in children with ASD. In addition, fNIRS-based activation may be a neurobiomarker to assess treatment-related changes following motor interventions.

163 **164.163** Cross Sectional Associations Between Measures of Social Function, Postural Control and Motor Coordination

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Background: Autism Spectrum Disorders (ASD) are c disorders of social communication and behaviour. Research and treatment focus is on the cognitive, social and behavioural aspects of ASD. Yet motor skill and postural control are significantly different in people with ASD with effect strength of 1.2. Postural control is needed for both social function and motor skill. The pattern of movement of the centre of pressure (COP) during standing represents the control processes underlying postural control. Sample entropy measures the regularity or amount of information in a signal. Less entropy in the COP signal indicates more regular COP fluctuations and more active control of posture. The effective use of visual information is critical to the development of motor function, postural control and social function. The relationship between social function, postural control and motor coordination has not been reported in research literature. The relationship among these factors may inform potential causal pathways in ASD.
Objectives:
To determine the cross sectional associations between measures of social function, postural control and motor coordination.
Methods:
Cross sectional study design. 49 adults selected for their ASD status (n=19) or typically developed (TD) status (n=29) were tested for postural control in quiet stance during eyes open (EO) (30 seconds) and eyes closed (EC) (30 seconds). Only 46 had complete data for postural control (3 TD missing). The sample entropy of each 30 second signal was calculated for the mediolateral (ML) and anterior-posterior (AP) sway. Motor coordination was assessed using the McCarron Assessment of Neuromuscular Development (MAND)-the MAND gross motor (GM) score was used. ASD symptomology was assessed using the Social Responsiveness Scale (SRS-2). All measures were continuous and were compared using Pearson correlation with $p<0.05$ considered as statistically significant. Stepwise linear regression with pin=0.05 and pout=0.10 was undertaken.
Results:
Correlations were statistically significant between the SRS-2 score and the MAND GM score (r=-0.445, p=0.002); the MAND GM score and the sample entropy of the mediolateral sway component during eyes open (r=-0.355, p=0.015). Entropy measures with eyes closed (EC-AP, EC-ML) were not significantly related to the MAND GM score or the SRS-2 (p>0.508). EO-AP sample entropy was not significantly related to the SRS-2 score at p=0.082 (r=-0.259). Stepwise linear regression of SRS-2 against the other variables resulted in a model that explained 23% of the variance (adjusted r square) in the SRS-2 score. SRS-2 = 81.735-0.381 (SE 0.112)(MAND GM) -61.298 (SE 26.992)(sample entropy EO-AP).
Conclusions: Nearly one quarter of variation in social impairment (higher SRS-2) could be explained by poorer gross motor function (lower MAND GM) and more active control of sway in the AP direction with vision. AP sway is generally controlled by the somatosensory system. The findings suggest that these factors are independently related to social impairment. Poor gross motor function was related to a less controlled posture in the mediolateral direction. Mediolateral sway is controlled primarily by visual fixation and the finding supports the hypothesis that poor gross motor function may be related to a lower sensory weighting of vision in postural control.

164 **164.164** Deficits in Taste Identification, in the Context of Intact Taste Sensitivity, in Autism Spectrum Disorder

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Background: Atypical sensory processing is widely appreciated as a symptom of autism spectrum disorder (ASD). Experimental data exists across all sensory domains, with a dearth of studies in the domain of gustation (i.e., taste) compared to other sensory domains (e.g., vision, audition). Gustation is important to consider in ASD, not only in the context of sensory processing, but also because atypical taste perception could contribute to the known feeding difficulties associated with ASD (e.g., picky eating). In addition, it remains unknown if taste perception differences exist more broadly across family members with ASD, or if they are specific to individuals with ASD. Taste perception can be evaluated at two levels, taste sensitivity and identification. Taste sensitivity is associated with brainstem functioning whereas taste identification relies on cortical processing networks. Assessing taste at these levels allows us to test for possibly dissociable differences in neural functioning in the context of gustation.
Objectives: Â The purpose of this study was to assess gustation, at the level of both taste sensitivity and taste identification, across three groups: individuals with ASD, unaffected siblings of individuals with ASD, and typically developing (TD) controls.
Methods: Â 81 children, adolescents, and young adults (ages 10-25) with well-characterized ASD, 51 unaffected siblings, and 69 age- and IQ-matched TD controls completed two tasks assessing gustation. Electrogustometry was used to estimate taste sensitivity thresholds on both sides of the tongue using an adaptive staircase procedure. Taste identification was evaluated via "Taste Strips," which assessed identification of sweet, sour, salty, and bitter stimuli, each presented at four concentration levels. A 3 (group) x 2 (side of tongue) mixed-model ANOVA was used to test for differences in taste sensitivity. A 3 (group) x 4 (taste) mixed-model ANOVA investigated differences in taste identification abilities. Follow-up tests were conducted accordingly.
Results: Analyses revealed similar electrogustometry thresholds across groups ($F = 2.46$, $p > .05$). In contrast, there were significant group differences in taste identification accuracy (main effect of group: $F = 14.99$, $p < .001$), with post-hoc Tukey tests indicating that individuals with ASD had significant deficits in overall taste identification compared to both unaffected siblings ($p < .001$) and TD controls ($p < .001$). However, there was no group x taste interaction ($F = .63$, $p > .05$), suggesting consistent impairment in ASD participants across all individual tastes.
Conclusions: This study showed impaired taste identification in the context of intact taste sensitivity in ASD. This suggests that while brainstem functioning seems intact, cortical networks required for taste identification may be selectively disrupted ASD. Unaffected siblings were strikingly similar to TD controls, suggesting that deficits in taste identification is specific to the ASD phenotype and not represented more broadly in family members. Ongoing analyses are exploring gustatory misperceptions (via confusion matrix analyses) and examining how differences in taste perception impact restricted food preferences and vary in the parents of individuals with ASD.

165 **164.165** Defining the 'Autism Motor Signature': Characterisation of Motor Patterns of Children with Autism during Ipad Gameplay

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Background:
New evidence indicates disruption to motor timing and integration may underpin autism spectrum disorder (Trevarthen & Delafield-Butt, 2013).Â In previous work, we employed smart tablet computers with touch-sensitive screens and embedded inertial movement sensors to record the movement kinematics and gesture forces made by children with autism and children developing typically. Machine learning analysis of those children's motor patterns identified autism with 93% accuracy, supporting the notion disruption to movement is core feature of autism, and demonstrating autism can be computationally assessed by fun, smart device gameplay (Anzulewicz, Sobota, & Delafield-Butt, 2016). Machine learning analysis is a powerful tool, but it is a 'black box' approach.Â Here, we present new analyses to better define the nature of the motor disruption and therefore to better characterize the 'autism motor signature'.
Objectives:
(1) Determine the kinematic features that characterize the autism motor signature during iPad gameplay.
(2) Define these in terms of motor control properties to better understand its nature.
Methods:
37 children 3-6 years old clinically diagnosed with Childhood Autism and 45 age- gender-matched children developing typically were included. Children with sensory or motor impairment were excluded. iPad mini tablet computers employed two education games: *(1)* 'Sharing' where the main gameplay was to divide a piece of food (e.g. an apple) and distribute it evenly among four children on the screen; and *(2) Creativity* where gameplay was open, unstructured colouring of a toy or animal. Children were seated at a table and the iPad placed in front of them. A five minute unassisted 'experimental' phase was preceded by a two minute assisted 'training' phase.Â Data was collected during 'experimental' gameplay from the tablets' inertial sensors (tri-axial accelerometer, tri-axial gyroscope and magnetometer) and touch screen.Â Raw values and simple kinematic calculations (e.g. gesture duration, amplitude, acceleration, etc.) produced 262 'features' analysed in previous machine learning work with a classification accuracy of 93%.Â These same features were extracted and analysed using standard statistical multivariate analyses.
Results:
Features associated with greater forces made at contact and forces put into the device within a gesture were greater and more variable in children with autism than in children developing typically, respectively.Â Further, gesture kinematics were faster and larger, with more distal use of space in children with autism. And children with autism made faster taps on the screen.
Conclusions:
iPad gameplay stands in agreement to standard measures, providing and accessible new paradigm for autism research. A particular motor pattern characterised by greater impact forces was apparent, supporting the notion that termination of a movement is different, difficult, or disrupted in autism. This finding corroborates data in reach-to-grasp and reach-to-place paradigms that demonstrate greater velocity at the termination of a movement (Crippa et al., 2015). Identification of greater variation in the distribution of forces during a gesture corroborates with reach-to-grasp motion capture data (Cook et al., 2013; Torres et al., 2013). Thus, it appears sub-second regulation of children's intentional movements and timing their termination are two key features of the autism motor signature.

166 **164.166** Determining the Target Postures of Affective Facial Expression in Autism Spectrum Disorder

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Background: The generation of affective facial expressions involves deforming the face to achieve target postures. As a disorder of social communication, Autism Spectrum Disorder (ASD) may involve an atypical inventory of target postures for affective facial expression. Identifying target postures of the face and quantifying the size of target posture inventories may provide insight into how ASD perturbs the motor organization of communicative behavior. These perturbations to affective facial expression may be among the mechanisms which give rise to the perceived atypicality of affective facial expression in ASD.
Objectives: We used a motion capture system in order to identify target postures in the affective facial expressions of children with high-functioning autism (HFA) and typically developing (TD) children. Specifically, we clustered the sampled motion capture marker positions into target postures of the face. We quantified the difference in size of HFA and TD target posture inventories.
Methods: Subjects included 21 children with HFA and 16 TD children, aged 9-14. The experimental task was to watch and mimic the affective facial expressions shown in short video clips. These facial expressions exhibited either Anger, Sadness, Disgust, Surprise, Fear, or Happiness. Each child mimicked 18 expressions. Six motion capture cameras recorded the position of 28 markers and 4 reference sensors on the face at 100 frames per second. Using the reference sensors, a basis was chosen which expressed the position of the 28 markers independently of rigid head motion. The sampled marker positions were clustered into target postures using the k-means algorithm for each recording separately. The number of clusters k was determined as the smallest number for which the clusters explained a threshold percentage of the variance. We varied the threshold over 70%, 80%, and 90% in order to assess the sensitivity of the method. Explained variance was calculated as the ratio of the quantity (1 - within cluster sum of squares) to the total sum of squares. Lower face markers were clustered separately from upper face markers.
Results: In our sample, children with HFA differed from their TD peers in the number of target postures achieved for Anger, Sadness, Disgust, Surprise, Fear, and Happiness. This reflects a quantifiable size difference in the target posture inventories of the HFA and TD groups.
Conclusions: Children with HFA may develop different target posture inventories for affective facial expression than their TD peers. This reflects how ASD perturbs the motor organization of communicative behavior. Further analysis of motor atypicalities will shed light on the mechanisms underlying the perceived atypicality of affective facial expression in ASD.

167 **164.167** Earlier ASD Age of Onset Is Associated with More Amounts and More Severe Restricted and Repetitive Behaviors

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Background: Restricted and repetitive behaviors (RRBs) are a core feature of Autism Spectrum Disorders (ASD) (DSM-V, 2013) that can interfere with many aspects of daily functioning (Richler, Heurta, Bishop, & Lord, 2010). For some children, these impairing behaviors are present from as early as 20 months of age (Cox et al, 1999). Moore and Goodson have also shown that the total number of RRBs tend to increase between 2 and 4 years of age (Moore and Goodson, 2003). While research has indicated a relationship between age and RRBs (Richler et al, 2011; Cox et al, 1999; Moore & Goodson, 2003), less is known about the specific relationship between the age of onset of ASD symptomatology and the presence and severity of RRBs.
Objectives: In this study, we explored the role of age of onset of ASD symptoms on the total number of RRBs and the severity of RRBs.
Methods: Â A sample of 473 participants (82% male) aged 36-272 months (SD=48.3, Mean=98.7) were examined for the current study. The Autism Diagnostic Observation Schedule (ADOS) (Lord et al, 2003) and Autism Diagnostic Interview-Revised (ADI-R) (Rutter et al, 1994) was used to verify ASD diagnosis for all participants. The ADI-R was used to evaluate participant's age of onset of symptoms (Question 87). The Behavior and Sensory Interest Questionnaire (BSIQ) (Hanson et al, 2016) was administered to evaluate the total number of RRBs and the severity of those RRBs. Descriptive statistics, a Spearman Rank Test and Mann Whitney U Tests, as the data was not normally distributed, were used to determine the relationship between age of onset and the presence and severity of RRBs. Consistent with prior research, we used norms for early age of ASD onset that have already been set in the field: Early Onset is defined by ASD symptomatology noticed before or at 2 years of age (Baraneck, 1999; Werner et al., 2000), while Late Onset is defined by ASD symptomatology noticed after 2 years of age (Palomo, Belinchon, & Ozonoff, 2006).
Results: Age of Onset was negatively correlated with total amount of RRBs overall ((r(473) = -0.080, p = 0.081) and the total amount of severe RRBs (r(473) = -0.114, p=0.013). Children who experienced Early Onset had significantly more RRB symptoms than children who experienced Late Onset (p=0.019).
Conclusions: Overall, children with Early Onset present with more RRBs overall and more severe RRBs than children with Late Onset. This indicates that there is a relationship between age of onset of ASD symptoms and the presence and severity of RRBs. Additional studies evaluating the effect of services provided to the child may be a potential mediator between age of onset of symptoms and RRBs.

168 **164.168** Evaluating Multimodal Driver Displays of Varying Urgency for Drivers on the Autistic Spectrum

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Background: Individuals with ASD demonstrate alterations in sensory processing within different modalities and uncommon responses to sensory stimuli across multiple sensory domains. It is important to note that abnormal sensory processing does not necessarily mean worse performance, as there is evidence of enhanced perceptual functioning in autism. Recent studies show differences of multisensory perception between typically developed and ASD individuals that potentially can lead to difficulties in the integration of multiple sensory signals in everyday situations, such as driving. This is relevant since diverse modes of sensory information can be used to warn a driver and multisensory warnings incorporating two or more modalities show promise in their effectiveness.
Objectives: To evaluate the effectiveness of multisensory warning signals, designed to indicate different levels of urgency, in individuals on the autism spectrum.
Methods: The study involved 20 male (10 typically developed and 10 ASD) participants. The ASD group was defined by having an AQ score over 26 and had an average AQ score of 40.3. Two experiments were conducted: (1) Experiment 1 examined perceive urgency and annoyance with the warnings and (2) Experiment 2 measured recognition accuracy of the level of urgency and the reaction time during a simulated driving task.
Warning design: The warnings used in this study were similar to those of a previous study (Politis, I. et al (2013)). Totally, twenty-one different signals were obtained from the combination of: (1) three levels of designed urgency (LDU) and (2) seven sensory conditions which included unimodal, bimodal and trimodal combinations of audio, visual and tactile.
Results: The results of Experiment 1 revealed that there was no difference between TD and ASD groups in the perceived urgency of the warning signals, though the autism spectrum group reported lower annoyance with the signals than TD group ((*F*(1,58) = 13.22, *r* = 0.43, *p* < 0.01)). Experiment 2 showed that while both groups exhibited high accuracy in correctly reporting urgency level, the autism spectrum group performed better (*Q*(1) = 11.80, *p* < 0.01). Moreover, the fastest overall reaction times obtained were by the autism spectrum group when the warning included a visual component, with vision alone (*F*(1,57) = 5.62, *r* = 0.30, *p* < 0.001) producing the quickest response.
Conclusions: This study compared how typically developed people and individuals with ASD responded to a set of multimodal combinations to alert drivers to events of varying urgency. Two group difference were found in that the ASD group reported the warning signals to be less annoying than the typically developed participants and the ASD group showed an advantage in response time when the warning included a visual modality, in particular for the vision-only condition. These results highlight that while there are similarities, substantial performance differences exist between typical and autism spectrum individuals, suggesting that consideration of these differences can contribute to the design of effective warning signals.

169 **164.169** Exploratory Factor Analysis and Test-Retest Reliability of the Sensory Environment and Participation Questionnaire (SEP-Q)

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Background: The ability to participate in common daily activities can have a profound impact on the development of young children. One factor identified to impact daily activity for children with Autism Spectrum Disorders (ASD) is the fit between individual sensory processing patterns and the sensory environment (Reynolds, Bendixon, Lawrence, & Lane, 2011). It is estimated that 70-96% of all children with ASD have unusual responses to sensory stimuli in the environment (Ben-Sasson et al., 2009). Unfortunately, there are few instruments that measure the environmental impact on participation in natural environments for children with ASD and even less that measure the sensory characteristics of the environment. The SEP-Q was developed to fill this need, although requires further examination to determine underlying structures of the variable, internal consistency, and test re-test reliability prior to clinical use.
Objectives: The objectives of this study was to examine internal consistency, factor structure, and test-retest reliability of the Sensory Environment and Participation Questionnaire (SEP-Q) in young children with ASD. The SEP-Q measures parents' perspective of the impact of the sensory environment on participation, as well as parent effort to support participation both in home and community environments.
Methods: Â A cross sectional design was used to collect data for psychometric analyses. Participants were 125 parents of children with ASD between the ages of 3 and 5 years old. Recruitment occurred nationally through social media, ASD community/support groups, private preschools, and school districts. Participants completed the SEP-Q, along with the Gilliam Autism Rating Scale (GARS) to confirm diagnosis, and a demographic questionnaire. Participants were emailed a link to collect data through Qualtrics Survey software or were provided with a paper version of the questionnaires based on preference. Cronbach's alpha was used to calculate internal consistency. Canonical correlations and Intra-Class Correlation (ICC) were used to calculate test re-test reliability. An exploratory factor analysis using principle axis factoring was completed using Stata software.
Results: Â The exploratory factor analysis identified the best fit as a two-factor model for both Home and Community scales of the SEP-Q.Â Internal consistency for both subscales representing the two factors was high. Cronbach's alpha for the first factor of the Home scale was .87 and .82 for the second factor.Â Cronbach's alpha for the first factor of the Community scale was .87 and .91 for the second factor. Test re-test reliability for all subscale factors were in ranges considered good (.82-.99).
Conclusions: Â The results of this study identify the underlying factor structure and provide initial reliability for a unique measure to assess the impact of sensory factors within natural environments from the perspective of key stakeholders. The SEP-Q has the potential to support the intervention process within home and community contexts for therapist and families of young children with ASD.

170 **164.170** Gait Analysis and Motor Performance in Children with Autism Spectrum Disorders during Discrete Gait Perturbation

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Background: It has been hypothesized that studies on motor function could have significant potential in providing critical insights into the neurobiological basis of Autism Spectrum Disorder (ASD) and in improving its diagnostic characterization (Minshew et al., 2004). On the basis of decades of anatomical and imaging data (Becker & Stoodley, 2013), it has been suggested that the cerebellum could be primarily implicated in ASD. Moreover, the cerebellum has been known to control and adjust gait. Quantitative methods, such as gait analysis, could offer insight on a possible motor signature of ASD that may potentially identify a well-defined motor phenotype within the spectrum.
Objectives: To describe gait patterns and motor performance during discrete gait perturbation in children with ASD compared to typically developing peers.
Methods: Five children with ASD (mean age: 9.2 years) and eight typically developing children (TD) matched by gender and age were enrolled. Gait analysis was carried out in an immersive virtual environment using a 3D motion analysis system with a dual-belt, instrumented treadmill (GRAIL). After 6 min of walking at a comfortable pace, a 20-steps cycle was recorded as baseline. Then, each participant was exposed to 20 trials with a discrete gait perturbation: after a random number of steps, a single perturbation was applied to the dominant side at toe-off, using a split-belt acceleration. Immediately afterwards, a 20-steps cycle was acquired. Finally, at the end of the perturbed trials, we recorded a 20-steps cycle as post perturbation trial. Gait parameters were extracted as previously done (Biffi et al.,2015). Data recorded in perturbation trials were linearly interpolated and R^2 value was used to estimate the goodness of responses to perturbation. Paired and non-paired non-parametric tests were performed within and between groups.
Results: At baseline, children with ASD had significantly increased stance time, reduced range of motion, peak extension, and peak of power at the ankle, increased time of maximum knee flexion with a more negative minimum moment, increased intrarotation of hip and increased pelvic tilt at the initial contact (all $p<0.05$). With respect to perturbation trials, R^2 values for parameters of the perturbed step were significantly higher for TD children ($p<0.001$). Finally, a baseline vs. post perturbation comparison showed in TD children significant increased stance time, maximum extension at hip, abadduction ROM of hip, maximum moment at hip and ROM of pelvic obliquity. In contrast, ASD showed only a reduced time of maximum flexion at hip.
Conclusions: These preliminary findings extend an earlier investigation of our group, depicting gait abnormalities in children with ASD, as stiffer gait and difficulty in balance control (Nobile et al., 2011). With respect to response to discrete perturbation, our results indicate a small but significant adaptation in both groups; however, TD children showed a better rate of adaptation compared to children with ASD. Finally, the observation of greater aftereffects in TD children seems to confirm that they were more able to adapt and store an effective response to perturbation than children with ASD.

171 **164.171** Gender Differences in Autism Spectrum Disorder on Teacher Ratings of the Restricted Behavior Scale-Revised (RBS-R) and the Aberrant Behavior Checklist (ABC)

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Background: Though gender differences in the prevalence rates of autism spectrum disorder (ASD) are widely known and acknowledged, the gender differences in behavioral manifestations of ASD are less known. Some studies claim no differences in profiles between the genders (Andersson, Gillberg, & Miniscalco, 2013), while others report that females show higher levels of functional social behavior and lower levels of and/or different quality repetitive behaviors (Halladay, Bishop, Constantino, Daniels, Koenig, Palmer, Messinger, Pelphrey, Sanders, Singer, Taylor, & Szatmari, 2015; Mandy, Chilvers, Chowdhury, Salter, Seigal, & Skuse, 2012). Given the mixed results and the potential implications for screening, diagnosis, and treatment, it is important to investigate gender differences further.
Objectives: The current study was conducted to investigate gender differences measured on the RBS-R and ABC for children with ASD.
Methods: *Participants.* Teacher ratings on the RBS-R and ABC were collected for 60 children (30 female, 30 male) with ASD. The population was primarily low-functioning based on IQ (mean IQ = 48.97 *sd* =16.54). Female students were matched with male students based on age, IQ, and ethnicity. Average age across the sample was 10.40 (*sd* = 3.37).
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Measures. The Aberrant Behavior Checklist (ABC; Aman & Singh, 1986) is a rating scale designed to measure five broad areas of behavior: irritability, lethargy/social withdrawal, stereotypic behavior, hyperactivity/noncompliance, and inappropriate speech. The Repetitive Behaviors Scale – Revised (RBS-R; Bodfish, Symons, Parker, & Lewis, 2000) is a rating scale designed to measure restricted repetitive behavior, a diagnostic feature of autism spectrum disorders (ASD).
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Procedures. Teachers completed the RBS-R and ABC as part of a battery of program evaluations collected at the beginning of the school year. Rating forms were scored and entered by research assistants. Data analyses included descriptive statistics, independent samples *t*-test, and Cohen's effect size *d*.
Results: Teacher ratings showed some significant gender differences among children with ASD among the different scales on the RBS-R. On the RBS-R, significant gender differences were found on the restricted behavior subscale ($t(56) = 2.38$, $p = .021$, $d = 0.61$). There were differences found on the subscales of the ABC, but none statistically significant.
Conclusions: Teacher rating on the RBS-R and ABC indicated mixed results regarding gender differences. Similar to prior research, there was some indication of males showing more repetitive behaviors than females with ASD; however, this was only noted on the restricted behavior subscale of the RBS-R (i.e., preoccupation with one subject or activity, attachment to one specific object, preoccupation with parts of objects, and preoccupation with movement).Â Females and males with ASD seem to have similar symptomatology regarding sameness behavior, ritualistic behavior, compulsive behavior, self-injurious behavior, and stereotyped behavior. Additionally, females and males with ASD tend to show the same levels of irritability, lethargy, stereotypic behavior, and hyperactivity. These results can have implications in the diagnosis and treatment of ASD. Further research is needed in the area of gender differences and level and quality of restricted and repetitive behaviors in children with ASD.

172 **164.172** Growth Mixture Modeling of the Repetitive Behavior Scale-Revised in Young Children with ASD

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Background: There are few data on how restricted and repetitive behaviors (RRB) emerge and change over time in young children with ASD. A handful of longitudinal studies provide some evidence that these patterns may differ based on type of behavior (e.g., higher order versus lower order) and age range.
Objectives: The goal of this analysis was to evaluate the trajectories of subtypes of repetitive behavior, as measured by the Repetitive Behavior Scale-Revised (RBS-R), in a sample of children with ASD and low cognitive and adaptive function. We sought to determine whether the data were best represented by a mixture of trajectory classes, rather than a single, average trajectory, using growth mixture models.
Methods: Data were drawn from a longitudinal natural history study of 106 children with ASD (DSM-IV autistic disorder) assessed at up to five approximately one-year intervals. The age range for the longitudinal data thus spanned 2 to 7 years. We first evaluated the standard growth models for each RBS-R subscale and the total score, followed by growth mixture models of increasing complexity. Where clustering around zero was common, models for censored data were used. Solutions with up to 4 classes were compared on a range of fit indices. Due to sample size constraints, joint trajectories were not modeled, but the joint distributions of most likely class membership across trajectories were calculated. Finally, correlates of class membership, such as level of cognitive impairment, were explored.
Results: For all subscales, the mixture model was better fit to the data than the standard growth model, indicating that the growth model was not adequately accounting for heterogeneity in trajectory. For the purposes of space, we present in this abstract only the best-fitting solution to the Self-Injurious Behavior (SIB) subscale. This was a 4-class model (Figure 1). 41% of the sample was most likely assigned to the No SIB class and 49% to the Mild/Stable class. The remaining classes were small but clinically meaningful, and were therefore retained: Moderate/Valley (6%) and High/Peak (4%). Data on correlates, other subscales, and their joint distributions, will be provided.
Conclusions: These analyses revealed considerable heterogeneity in the developmental trajectories of repetitive behavior in children with autism, as well as across types of repetitive behavior, providing more evidence for the notion that developmental trajectories may be required for ASD phenotyping.

173 **164.173** Higher-Order Repetitive Behaviors in Toddlers Born Preterm

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Background: Preterm birth is associated with lower IQ, impaired self-regulation, and social communication deficits. Preterm infants are also more likely to receive psychiatric diagnoses including ASD, the prevalence of which is 7% in children born preterm (as compared to 1.5% in the general population) (Johnson et al., 2010). These findings add to the extant literature suggesting the heterogeneous etiology of ASD, and highlight the need for screening tools that capture the dimensionality and heterogeneity in contributing mechanisms and clinical outcomes of ASD.
Objectives: The current study uses the Repetitive Behavior Scale for Early Childhood (RBS-EC; Wolff, Boyd, & Elison, 2016) to compare restricted and repetitive behaviors (RRBs) in preterm (36 weeks gestational age or earlier) and full term toddlers in a community sample of 1,670 participants.
Methods: Parents of toddlers between 17 and 23 months of age were recruited from the Institute of Child Development participant pool registry. Parents were asked to fill out the RBS-EC, an instrument designed to characterize dimensional aspects of RRBs in young children. Of the 1,955 parents who completed the RBS-EC, 285 were excluded for providing responses that suggested invalid data (e.g. time to complete survey was less than 3 minutes) or for missing gestational age data.
Results: Â Data from 1,670 participants were analyzed. Of these participants, 5.9% were born preterm (n=99). The average age at assessment did not significantly differ between groups (Preterm Infants' Mean Age=20.6 months, Fullterm Infants' Mean Age=20.1 months). Overall, parents of preterm toddlers endorsed a greater number of behaviors (t(1666)=2.7, p=.007) and reported a higher frequency of these behaviors (t(1666)=1.9, p=.05). Analyses of the subscales on the RBS-EC indicated no group differences in Self-directed or Repetitive Motor topographies. Group differences emerged in Restricted and Ritual topographies, with parents of preterm toddlers endorsing more items and reporting higher frequencies of these behaviors (**Table 1**). Birthweight, Gestational Age, and Age at Assessment were then entered in a multiple linear regression model. Birthweight significantly predicted the number of Restricted Behaviors Endorsed (t(1666)=-3.3, p=.001), the frequency of Restricted Behaviors (t(1666)=-2.9, p=.003), and the frequency of Ritual and Routine Behaviors (t(1666)=-2.5, p=.01) after controlling for Gestational Age and Age at Assessment. The effect of Birthweight on the number of Ritual and Routine Behaviors endorsed trended towards significance (t(1,666)=-1.7, p=.089).
Conclusions: RBS-EC measures collected from a large community-based sample (n=1,670) indicate that infants born preterm do demonstrate a greater degree of higher-order RRBs as toddlers, as indexed by both topographies endorsed and frequency of these behaviors. Future analyses will expand on these findings by using continuous measures of Age and Gestational Age to better understand the effect of preterm birth on RRBs. Furthermore, data collected on a social-responsiveness measure – the vrRSB – in the same cohort will be analyzed to determine whether these effects are specific to RRBs, or to features of ASD more generally. These data add to the growing body of evidence demonstrating that preterm birth is a risk factor for ASD by identifying elevated RRBs during the second year of life.

174 **164.174** IQ As a Moderator of the Presence, Severity, and Fluctuation Rates of 3 Individual Rrbs: Bouncing, Lining up Objects, and Aversion to Loud Noises

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Background: The presence of restrictive and repetitive behaviors (RRBs) is required for a diagnosis of Autism Spectrum Disorders (ASD) and can have a devastating impact on children and their families (Richler, Heurta, Bishop, & Lord, 2010). Previous researchers observed that IQ moderated the presence of groups of RRBs (insistence on sameness and repetitive sensory motor, Bishop et al, 2006 Bishop et. al 2013). There continues, however, to be a lack of research assessing the characteristics of individual RRBs to help clarify ASD and other syndrome profiles.
Objectives: The current study examined the moderating relationship between NVIQ and VIQ and the presence, severity, and fluctuation of three prevalent, individual RRBs.
Methods: A sample of 458 children were used in analysis. All participants had a research confirmed ASD using ADOS and ADI; Comparison Severity Score (CSS) was used from the ADOS. IQ was assessed using standardized cognitive measures. The prevalence of individual RRBs was analyzed in a previous study that used the Behavior and Sensory Interest Questionnaire (BSIQ, Hanson et. al. 2015). This analysis used three very common RRBs: Bouncing, Lining up Objects and Aversion to Loud Noises (all found in > 50% of the population). We fit logistic regression models to determine the moderating relationship of IQ on presenting RRBs using two interaction variables: a) CSS and VIQ; b) CSS and NVIQ. RRB presence (0-1), severity (0-3) and fluctuation (0-1) were included in separate models as dependent variables. ANOVAs were run to assess the differences between groups. All statistics were run using SPSS.
Results: None of our regression models reached significance. NVIQ, VIQ, and CSS were not associated with a significant increase or decrease in the presence, severity, or fluctuation rates of Bouncing, Lining up Objects, or Aversion to Loud Sounds. While our ANOVAs and T-tests were also not significant, they revealed trends between NVIQ and VIQ and our behaviors. Mean NVIQ decreased approximately ten points between individuals who did not endorse Bouncing and those who did; there was no trend between VIQ and Bouncing. In contrast, mean VIQ decreased 5 points between individuals who did not endorse Lining up objects and those who did; there was no trend between NVIQ and Lining up objects. Finally, mean NVIQ decreased 4 points and mean VIQ decreased 7 points between individuals who did not endorse Aversion to loud noises and those who did.
Conclusions: Our results indicate that continuing to analyze RRBs on an individual basis reveals important information about distinct RRB characteristics that studying them on a grouped basis alone does not, especially in terms of the moderating effect of IQ. While none of our regression models or ANOVAs reached significance, the models assessing the fluctuation rates were the closest. This suggests to us that NVIQ and VIQ may be contributing factors of behavior change over time. Research examining the moderating role of IQ on all 74 RRBs of the BSIQ is in progress.

175 **164.175** Identifying Genetic and Behavioral Correlates of Sensory Issues in Autism Spectrum Disorders

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Background:
Sensory modulation characteristics are now part of the DSM-5 Autism Spectrum (ASD) classification and defined as: “hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment” (DSM-5, p.50). Research regarding sensory modulation suggests that upwards of 80% of all individuals on the autism spectrum report some degree of hyper- or hypo-sensory sensitivity. However, there is almost no data on the possible genetic underpinnings that might be involved in sensory sensitivities and only minimal data reported on family members of individuals with ASD.
Objectives: We hypothesize that in addition to sensory modulations issues that affect individuals with ASD, nuclear family members might also present with sensory sensitivity characteristics but to a lesser degree. These behaviors could be considered a characteristic of the Broad Autism Phenotype (BAP) and thus, might be used as a behavioral phenotype in family genetics studies.
Methods: One hundred twenty-seven (127) probands with ASD and 316 of their nuclear family members participated in a family genetics study. All probands received the ADI-R and all family members, including the probands, received the Social Responsiveness Scale (SRS and SRS-2). We used questions 20 (related to hyposensitivity/sensory seeking) and 42 (related to hypersensitivity) to categorize all family members as affected for sensory modulation issues. For ASD probands, we also included ADI questions 71, 72, & 73 to calculate affection rates for sensory issues. We examined the rates of sensory issues in all family members and categorized each member as affected or unaffected for a preliminary linkage analysis.
Results:
Hyposensitivity-Based on a combination of SRS and ADI-R data, parents reported that 86.9% of ASD probands had hyposensitivity issues. Based on SRS data, 16% of fathers, 14% of mothers, and 17% of unaffected siblings (US) also reported hyposensitivity. Group differences were significant when ASD probands were included [X^2 (3, N=443), 261.277, p<.001] but not significant for family member status or sex when probands were excluded from the analysis.
Hypersensitivity- Based on a combination of SRS and ADI-R data, parents reported that 87.9% of ASD probands had hypersensitivity issues. Based on the SRS data regarding hypersensitivity, 26% of fathers, 17% of mothers, and 26% of US reported hypersensitivity. Group differences were significant when ASD probands were included [X^2 (3, N=443) 206.570, p <.001] but not significant for family member status or sex when ASD probands were excluded from the analysis.
Preliminary genetic linkage analysis- Linkage analysis was performed on both variables. We observed evidence of linkage (90% posterior probability) for the hypersensitivity variable on Chromosome 6 while there was no evidence of linkage observed for hyposensitivity.
Conclusions:
As predicted, ASD probands showed high rates of hypo- and hyper- sensitivity supporting the inclusion of sensory modulation in DSM-5 ASD diagnosis. Preliminary exploration of rates in unaffected family members also show some degree of hypo- and hypersensitivity suggesting that these characteristics may be included in the BAP, potentially being beneficial as a behavioral phenotype in family genetics studies such as ours.

176 **164.176** Increased Centre-of-Pressure Regularity during Quiet Stance in Adults with Autism Spectrum Disorder

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Background: Adults with autism spectrum disorders (ASD) demonstrate atypical postural sway however the underlying processes that cause this are unclear. One hypothesis is that people with ASD rely less on vision and more on somatosensory input when controlling posture. Less use of vision for postural control may put people with ASD at disadvantage in developing complex motor skills and adaptive behaviours. The movement of the centre of pressure (COP) during postural control represents the accumulation of control processes and responses to maintain an upright posture. In general, the mediolateral postural control depends more on visual information whereas the anteroposterior postural control depends more on somatosensory information. Entropy measures the regularity or amount of information in a signal. A larger magnitude of entropy indicates more irregular COP fluctuations and higher automaticity of postural control.
Objectives: The primary aim of this study was to compare the regularity of the COP fluctuations in adults with ASD to their typically developed peers, with and without vision.
Methods: The study used a quasi-experimental case control design with nineteen adults with ASD and twenty-nine typically developed adults. COP position was collected at 100 Hz in two directional dimensions (mediolateral and anteroposterior) during quiet stance on a force platform in visual conditions of eyes open and eye closed. Each condition lasted for 30 seconds. Sample entropy and the Romberg quotient were calculated.
Results: Group differences in entropy were only evident in the eyes open condition in the anteroposterior direction (p=0.038). Mean entropy was smaller in the ASD group by 0.029 (95% CI -0.056 to -0.002). No difference was observed in entropy between the groups in the eyes open condition in the mediolateral direction (p=0.337), and the in the eyes closed condition in either direction (mediolateral p=0.716 and anteroposterior p=0.904, respectively). Additionally, the Romberg quotient of adults with ASD was significantly lower than that of typically developed adults (p=0.032). The Romberg quotient in the ASD group was lesser by 0.217 (95% CI -0.415 to -0.194), indicating a smaller contribution of vision on standing postural control in adults with ASD than typically developed adults.
Conclusions: In the anteroposterior direction, adults with ASD had a smaller magnitude of entropy demonstrating COP fluctuations that were more regular compared with those of TD. Regular COP fluctuations suggest a less adaptable and more attention demanding control of posture. It also indicates a lesser automatic postural control in the anteroposterior for adults with ASD. Cognitive load, disease state, old age, restricted vision and concussion have all been reported to be associated with more regular COP fluctuations. In combination with the smaller contribution of vision on postural control in adults with ASD, the findings are consistent with the previously reported hypothesis that postural control in ASD is biased to somatosensory information. The findings of this study have implication on guiding the development of intervention in areas of motor skills for people with ASD.

177 **164.177** Intact Musical Abilities in Children with Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) is a complex neurodevelopmental condition characterized by socio-communication difficulties and atypical sensory perception, particularly in the auditory domain. Despite these impairments, individuals with ASD often have preserved or even enhanced musical skills (Ouimet et al., 2012; Heaton, 2003). Music is therefore insightful for studying auditory processing in ASD. However, music perception on the whole remains poorly understood and underexplored in ASD.
Objectives: The aim of the current study was to evaluate musical perception abilities in school-age children with ASD compared to typical developing (TD) children on a variety of musical tasks including pitch and rhythm discrimination as well as melodic memory. Based on the Enhanced Perceptual Functioning model (Mottron, 2006), we expected children with ASD to perform similar to or better than TD.
Methods: Participants were 28 children with ASD and 24 TD children aged 7-12 years old, matched on age (ASD M=10.5 years, SD=1.6; TD M=9.9 years, SD=1.7; p=.20) and IQ (ASD M=115.6 years, SD=14.6; TD M=119.8, SD=12.9; p=.31). Children with ASD were diagnosed using the Autism Diagnostic Observation Schedule. Exclusion criteria were IQ<85 (measured using the Wechsler Abbreviated Scale of Intelligence) or any hearing impairment. Musical ability was measured using the Montreal Battery for Evaluation of Musical Abilities (MBEMA, Peretz et al, 2013), a music battery with three subtests, 1) melodic pitch, 2) rhythm, and 3) musical memory. Performance accuracy (percent correct) was calculated for all subtests as well as a global score. Participants scoring below chance level (<.55) on the global score (ASD: n=4, TD: n=1) were excluded from analysis. Data was analyzed using repeated-measures ANOVA with group as the between-subjects factor and subtest as the within-subjects factor.
Results: Both ASD and TD performed similarly on the MBEMA. There was no significant main effect of group ($F(44)=.05$, $p=.82$), or group X subtest interaction, ($F(2,88)=.63$, $p=.54$). There was however, a significant main effect of subtest ($F(88)=6.272$, $p<.01$), with both ASD and TD performing better on the rhythm subtest than on the melodic pitch or musical memory subtests. A bonferroni post-hoc analysis yielded a significant difference between rhythm and melody ($p<.01$), as well as rhythm and memory ($p<.05$) but no mean difference between melody and memory ($p=.1.0$; Figure 1).
Conclusions: Children with ASD performed similarly to TD on melodic pitch, rhythm and memory perception tests. TD children in this sample showed a music perception profile similar to the sample the test was normed on (Peretz, 2013). These findings show that music perception abilities are intact in school-age children of average IQ, diagnosed with ASD. These results also provide evidence for preservation of auditory abilities in the musical domain in ASD. This work supports the use of music to improve functioning in other domains in ASD, and can guide future studies of music therapy.

178 **164.178** Interpersonal Sensory-Motor Synchronization in Adults with and without ASD during a Joint Improvisational Mirror Game

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Background:
Recent research on Autism Spectrum Disorders (ASD) suggests that individuals with autism may have a basic deficit in synchronizing with others, and that this difficulty may lead to more complex social and communicative deficits. The current project aims to conduct an in-depth investigation of interpersonal sensory-motor synchrony in ASD, using an innovative experimental paradigm - the Mirror Game (MG, Fig 1) – that allows high-resolution temporal and spatial motion tracking in an open-ended joint improvisation game (Noy et al., 2011). Using the MG, it has been shown that players can attain moments of highly synchronized *co-confident* (CC) motion, in which the players act as a *coupled unit*.
Objectives:
To investigate the ability of adults with ASD, as compared with typically developing (TD) adults, to synchronize their movements with another person.
Methods:
Participants: data from 27 participants with high-functioning ASD was compared with that of 39 TD adults.
MG procedure: two players face each other holding handles which can move along parallel tracks, and are told to "imitate each other, create synchronized and interesting motions, and enjoy playing together" (Fig 1a,b). All participants played against the same expert improviser. Participants were instructed to first lead the motion (Leader), then follow the experimenter's motions (Follower), and then engage in Joint Improvisation (JI), with no designated leader; in 3-minute trials. The motion of the two handles is sampled at 50 HZ (Fig 1c,d).
Data analysis: Players' synchronization was measured using the mean relative difference in velocity (*dV*) and the timing differences between zero-velocity events (*dT*). Segments of CC motion (Fig 1d) met the following criteria: $dv<0.95$, $dT<0.15$, and no more than one crossing of the acceleration=0 point (i.e., smooth movement, with no corrective jitter).
Results:
We found that individuals with autism *can* attain co-confident (CC) motion when playing the MG with an expert improviser. ASD participants engaged in overall less CC than TD participants (main effect of Group, $F(1,64)=10.6$, $p<.001$), and this was particularly pronounced when *following* an expert improviser (main effect of Role, $F(2,128)=7.11$, $p<.001$; and interaction effect of Role by Group, $F(2,128)=9.2$, $p<.001$; post-hoc between-group analyses in the Following round, $t(64)=6.78$, $p<.001$). Furthermore, ASD participants stayed in CC periods for a shorter duration of time than TD participants ($F(1,61)=8.82$, $p=0.04$).
Conclusions:
These data provide the first evidence, to our knowledge, that individuals with autism can attain highly synchronized, co-confident motion, when playing with another player in an open-ended joint improvisation game. At the same time, they suggest that individuals with ASD have an attenuated ability to engage and *stay* in highly synchronized motion over time. It is possible that individuals with ASD do not detect these periods of CC motions, or do not find them rewarding, hence leading them to disengage earlier from the synchronized motion. Future research should focus on determining the reasons for this attenuated synchronization on both motor and psychological levels.

179 **164.179** Investigating the Association Between Restricted Interests and Language Abilities As Groundwork for Novel Intervention Development

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Background: Evidence of restricted interests is a hallmark symptom of autism spectrum disorder (ASD). Current estimates suggest that up to 95% of children with ASD have at least one restricted or circumscribed interest, yet our ability to target or reduce these highly restricted interests and their associated behaviors with traditional pharmacologic and therapeutic/behavioral interventions has been limited to date (Boyd, McDonough, & Bodfish, 2012; Poustka et al., 2014; Turner-Brown, Lam, Holzclaw, Dichter & Bodfish, 2011). Moreover, it may not be clinically beneficial or practically necessary to do so. Rather, clinicians and researchers are increasingly *utilizing*circumscribed interests in the context of various interventions to bolster motivation, rapport, and to ultimately enhance treatment outcomes (e.g., Kryzak & Jones, 2015). Given that ASD is a highly heterogeneous condition, it will be important to identify which patients will be most responsive to such interventions. While the presence of restricted interests in ASD has been associated with higher cognitive functioning (Bishop, Richler & Lord, 2006), few studies have investigated the relationship between specific interests and language skills in this population.
Objectives: The purpose of the present study is to identify specific phenotypic and language traits within individuals with ASD that may make them well-suited for interventions that are designed to utilize circumscribed interests, rather than reduce or eliminate them. Specifically, this investigation seeks to clarify the relationship between language level and intensity of restricted interest in school-aged children with ASD.
Methods: Participants will include approximately thirty children (ages 6 years, 0 months to 10 years, 11 months; including females) with a diagnosis of ASD recruited from a multidisciplinary autism clinic. Each child will be administered various language tasks, including verbal subscales from the Wechsler Abbreviated Scale of Intelligence Scale-2nd Edition (WASI-II; Wechsler, 2011), the Peabody Picture Vocabulary Test, 4th Edition (PPVT-4; Dunn & Dunn, 2007) and the Pragmatics Profile of the Clinical Evaluation of Language Fundamentals, 5thEdition (CELF-5; Wiig, Semel, & Secord, 2013). In addition, parent reporters will be asked to complete the Interest Scale (Bodfish, 2014) and the Affinities Scale, an original measure adapted from the Interests Scale to specifically assess the level of interest in contemporary movies and characters that could be utilized in treatment technologies.
Results: Data collection is ongoing. Results will include sample descriptive data, means and standard deviations of the proposed outcome measures, and Pearson correlation statistics for restricted interest levels and various language abilities.
Conclusions: Results from the present study will help to clarify our understanding of the direction and strength of the relationship between restricted interests and language skills in school-aged children with ASD. These findings will significantly contribute to our limited knowledge of restricted or circumscribed interests and will directly inform subsequent intervention design and implementation. Results will contribute to a small, but emerging body of evidence that a new approach to addressing restricted interests in therapeutic interventions for some individuals with ASD may be warranted.

180 **164.180** Italian Cross-Cultural Adaptation of the Short Sensory Profile in Autism

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Background:
Autism is a neurodevelopmental disorder characterized by widespread abnormalities of reciprocal social interactions and communication, as well as severely restricted interests and highly repetitive behavior. Sensory processing problems are reported in children with autism spectrum disorders and are included in the diagnosis of autism in the latest Diagnostic and Statistical Manual of Mental Disorders (DSM-5). One of the most useful tools to assess sensory characteristics in ASD individuals is the Short Sensory Profile (SSP), but no Italian version of this instrument is currently available.
Objectives:
The aim of this study is to validate an Italian cross-cultural adaptation of the Short Sensory Profile.
Methods:
Following the guidelines for the process of cross-cultural adaptation of self-report measures (Beaton et al., 2000) we did a translation of the process (two independent translators) followed by a back-up translation (two independent translators) and a final review in which full agreement was reached by the study team. We also did a pilot study to apply the SSP in a sample of 46 Italian ASD individuals (7 females; 39 males; mean age 163.5 months – SD 34.3 months, range: 87 – 226 months). The ASD diagnosis was done using the DSM V criteria, and it was confirmed using the ADOS 2. We chose capable special education teachers who carefully and fully reported their behaviors.
Results:
The SSP mean total score of the sample was 147.65 (range 119-176) pointing out the presence of sensory function impairment (the expected value ranges between 155 and 190). Thirty-two percent (N = 15) of the participants obtained a typical performance total score (range 155-190), 30.4% (N = 14) obtained a probable difference score (range 142-154), and 37% (N = 17) obtained a definite difference score (range 38-141). The sensory function impairment resulted particularly severe in two of the Scale sections (table 1): “Underresponsive/Seeks Sensation” (8.7% belonging to typical performance score, 26.1% belonging to probable difference score, 65.2% belonging to definite difference score) and “Auditory Filtering” (17.4% belonging to typical performance score, 39.1% belonging to probable difference score, 43.5% belonging to definite difference score).Â The section “Low energy / Weak” has a total mean score in the range of probable difference (58.7% belonging to typical performance score, 2.2% belonging to probable difference score, 39.1% belonging to definite difference score). The others sections (“Tactile sensitivity”, “Taste/Smell Sensitivity”, “Movement Sensitivity”, and “Visual Auditory Sensitivity”) have a mean score in the range of typical performance (table 1).
Conclusions:
The Short Sensory Profile scale is now validated forÂ use in Italy. The performance of the scales are in line with findings observed in the SSP literature. We confirm the existence of sensory impairments in ASD, particularly expressed as under-responsiveness or seeking stimuli and an increased or decreased response to auditory stimuli.

181 **164.181** Measuring Restricted Interests and Repetitive Behaviors in Infant Siblings at-Risk for ASD: Comparing HOME-Setting Versus Clinic Performance of 12 Month Olds

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Background:
Approximately 20% of younger siblings of children with ASD are at an increased risk for developing ASD (Ozonoff, 2011). According to DSM-5, symptomatology involves restricted, repetitive patterns of behavior (RRB); however, these indicators are only more recently examined in younger siblings. During the second and third year, studies have demonstrated repetitive hand/finger mannerisms become more pronounced among children with ASD and less pronounced among children with developmental delays (DD) and typical development (TD). Zwaigenbaum et al. (2013) summarized prospective studies, in comparison to retrospective studies, more consistently identified RRB as early as 12 months in children with subsequent ASD diagnosis, citing atypical and repetitive behavior with objects and visual exploration of objects. Further, Stronach & Wetherby (2012) examined RRB among toddlers (mean age 20 months) in clinic and home settings, identifying higher presence of RRB in clinic, given the nature of structured probes and repeated presentations of objects.
Objectives:
This study examines the relationship between home observation and clinical assessment of RRB among 53 (projecting 70 by May 2017) 12-month old infants considered at-risk for ASD, given sibling status.
Methods:
High-risk, 12-month infant siblings were seen for communication assessments as part of a federally-funded longitudinal study examining risk and resilience. The assessment battery included two samples of early social-communication behavior: Communication & Symbolic Behavior Scales (CSBS-DP; Wetherby & Prizant, 2002) and a video-recorded home observation. The Systematic Observation of Red Flags of ASD (SORF) is an ASD-specific screening instrument that captures red flags related to social-communication and interaction and RRBs. The SORF was used to rate early symptomatology within clinic (Clinic-SORF) and home (Home-SORF) settings. Pearson's correlation examined linear association between red flags observed in the Clinic-SORF compared to the Home-SORF. Paired t-tests examined differences between number of social-communication and RRB red flags observed using Clinic-SORF and Home-SORF. Further, differences in four specific behaviors of interest from the RRB domain were explored: (1) repetitive movements with objects, (2) repetitive body movements/posturing, (3) sticky attention to objects, and (4) unusual sensory exploration/excessive interest in sensory aspects of environment.
Results:
Pearson's correlation indicated significant association between total observed red flags obtained from home and clinic settings (r= 0.382; $p<0.01$). There was no significant difference between the number of Social-Communication red flags observed in the Home-SORF and Clinic-SORF. However, there were significantly more RRB red flags observed on the Clinic-SORF compared to the Home-SORF. With further analysis at the item level in RRB domain, Clinic-SORF revealed a significantly higher score than Home-SORF for the following items: repetitive movements with objects ($p<0.001$), sticky attention to objects ($p<0.001$), and unusual sensory exploration/excessive interest in sensory aspect of environment ($p<0.001$). There was no difference between Home-SORF and Clinic-SORF for repetitive body movements/posturing.
Conclusions:
Findings suggest home observation and clinic assessment highlight similar social-communication and social-interaction vulnerabilities. Significantly though, while the CSBS is primarily examining communication, structured tasks involving objects and communicative temptations may reveal increased amounts of RRB, therefore exposing earlier symptomatology and providing more quantitative assessment of red flags in this diagnostic domain.

182 **164.182** Motor Behavior As a Qualitative Difference in the Spontaneous Production of Co-Speech Hand Gestures By Adults with Autism Spectrum Disorders

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Background:
Deficits in nonverbal communication are a required symptom for diagnosis of autism spectrum disorder (ASD). DSM-5 stresses that nonverbal communication in ASD is often characterized by *qualitative* differences, in addition to reduced frequency. These qualitative differences have been inadequately described, in part because qualitative features of behavior are by definition challenging to quantify. Here we examine one qualitative feature of nonverbal communication in ASD: motor behavior during spontaneously produced co-speech hand gestures.
The literature on co-speech gesture in ASD is limited, but suggests that qualitative differences, e.g., in how gesture is formed, used functionally, or integrated with speech, best discriminate ASD from typically developing controls (TDC). Atypical motor behavior is widespread in ASD, both across individuals and across possible motor acts. Reported differences in motor behavior in ASD include low muscle tone, atypical gait, and impairments in praxis/pantomime performance. In typical adults, motor features of gesture (e.g., frequency and size of movements) are associated with empathy, suggesting a relationship between motor behavior during communication and broader social-cognitive deficits associated with ASD.
Objectives:
The primary objective of this study was to determine whether differences in motor features, including movement frequency, size, and complexity, would be observed in co-speech gestures spontaneously produced by adults with ASD.
Methods:
Adults with ASD (n=24) and typically developing controls (n=10) were matched on chronological age, gender, and full scale IQ (all average or above). Data on 14 additional TDCs will be available and analyzed by May 2017. Participants completed a five-trial referential communication task, employed through two networked laptops, in which they described abstract three-dimensional monochromatic figures to a trained confederate. The task was designed to allow for back-and-forth conversational interaction in a controlled setting. All hand gestures produced during the task were tagged and coded for: (1) movement *frequency* (gestures per minute), (2) movement *size* (degree to which hand moved through space), and (3) movement *complexity*(single-handed vs. two-handed gestures).
Results:
Both groups performed very well on the task (96% accuracy across trials in both groups), and all participants in the study gestured at least twice during the 20-minute task (Range: 2-176 total gestures). Overall, participants with ASD produced less movement than those with TDC (p=.04, Cohens d=0.97; Figure 1), evidenced by marginally less frequent gestures (p=.11; Cohen's d=0.72) and significantly smaller movements (p=.005, Cohen's d=0.91) in ASD. There was a significant interaction between hand usage and group with a large effect size (p=.002, Cohen's d=1.23; Figure 2), with participants with ASD using more single-handed gestures and TDC participants using more two-handed gestures.
Conclusions:
During spontaneous interaction, adults with ASD produced fewer, smaller, and less complex co-speech gestures. Motor features of co-speech gesture as a qualitative difference in nonverbal communication in ASD vs. TDCs can be quantified. All features described here can be measured by existing technologies, with potential to increase both the precision and scale of measurement, allowing for larger samples, and possible use as a behavioral biomarker of ASD.

183 **164.183** Natural History of Tiptoe Behavior in ASD

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Background:
The literature confirms that 20-30% of individuals with autism walk on their tiptoes. In a previous study, we found that this behavior transpires not only during walking but also while standing and running, and described three mutually exclusive clinical functional classes. Systematic observations about the natural history of Tiptoe Behavior (TTB) in ASD children in the literature are scarce. Specifically, it is not known if TTB parallels the acquisition of standing, walking and running milestones or appears later on and if these milestones (using the criteria suggested by Dosman and Dedrick) are delayed compared to normally developing peers.
Objectives:
The aims of this retrospective study are: 1) to observe if TTB was exhibited simultaneously or subsequently to the acquisition of standing, walking and running milestones; 2) to describe, in those diagnosed subsequently, when TTB ASD subjects started to stand, walk and run compared to both normal population and non-TTB ASD subjects.
Methods:
Our study sample included 36 ASD subjects (34 males; mean age: 14.3 years) diagnosed with Autism according to the DSM V criteria, confirmed through ADOS 2 and under observation at our Institute. We asked all the subjects' parents to answer a structured interview. We collected information about standing, walking and running milestones. We also asked if and when TTB was observed and when it eventually stopped. Another therapist confirmed the presence of TTB using a standardized method we described in a previous study.
Results:
We found that 18 subjects (50%) never showed TTB, 13 TTB subjects (36%) present TTB at least in one of three previous described situations, while 5 subjects (14%) had TTB in the past but it later stopped. The mean age of standing acquisition of the ASD sample resulted in line with the normative values, without significant differences between TTB and non-TTB subjects (table 1). The mean age of walking acquisition of the ASD sample resulted higher compared to the normative value (16.4 months (9-30 range) vs 12 months (9-18 range) respectively) without significant differences between TTB and non-TTB subjects. The mean age of running acquisition in the ASD sample resulted higher compared to the normative value (26.55 months (12-72 range) vs 15 months (13-20 range)) without significant differences between TTB and non-TTB subjects (absolute difference in favor of non-TTB). We observed that Tip-toe behavior in TTB subjects started significantly later than the acquisition of standing and walking milestone (table 2). Conversely, there was no significant difference between running acquisition and the start of TTB while running.
Conclusions:
TTB subjects exhibit this behavior significantly later to the acquisition of standing and walking milestones while there is no significant difference between running acquisition and the start of TTB while running. No significant difference in the age of acquisition of standing, walking and running milestones between TTB and non-TTB ASD subjects was found. The ASD sample showed a delay in walking and running acquisition compared to the normative values. This finding, if confirmed in other studies, could be included in the clinical abnormalities constellation of autism.

184 **164.184** Noise and Autism Spectrum Disorder in Children: An Exploratory Survey

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Background:
With more students being educated in schools for Autism Spectrum Disorder (ASD) than ever before, architects and interior designers need to consider the environmental features that may be modified to enhance the academic and social success of autistic students in school.
Objectives: This study explored existing empirical research on the impact of noise on children with ASD and provides recommendations regarding design features that can contribute to noise reduction.
Methods: A survey, which addressed the impact of architectural design elements on autism-related behavior, was developed for teachers of children with ASD and distributed to three schools.
Results: Most teachers found noise control to be an important issue for students with autism and many observed children using ear defenders. In terms of managing issues related to noise, most teachers agreed that thick or soundproof walls and carpet in the classroom were the most important issues for children with ASD.
Conclusions: Suggested future research should address architectural considerations for building an acoustically friendly environment for children with autism, identifying patterns of problematic behaviors in response to acoustical features of the built environment of the classroom setting, and ways to manage maladaptive behaviors in acoustically unfriendly environments.
Keywords
Autism, ASD, Acoustics, Noise, Classroom, Built Environment

185 **164.185** Nonsocial Attentional Bias in Adolescents with ASD Is Not Influenced By the Inversion Effect

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Background: Circumscribed interests are a common expression of repetitive behaviors in Autism Spectrum Disorders (ASD); these behaviors tend to be nonsocial in nature and often reflect a disproportionate amount of attention and engagement, compared to social interactions. Our lab previously developed a task to quantify aspects of circumscribed attention for nonsocial information in visual arrays containing both social and nonsocial images (Visual Exploration Task, VET). Using this task, we have previously reported attentional patterns in ASD that are biased toward nonsocial information (e.g., increased number and duration of fixation) and away from social information. However, the mechanism underlying this bias remains unclear.
Objectives: Inverting visual information can lead to attention changes and recognition impairments, most commonly for holistically processed images, such as faces, but extend in some individuals to domains of individual expertise (e.g., cars, birds). The purpose of this task was to assess the influence of inversion on social and nonsocial information in adolescents with ASD, compared to typically developing (TYP) peers.
Methods: Attentional parameters were measured for samples of adolescents with ASD (N = 15; mean age = 13.9 years) and TYP (N = 17; mean age = 13.8 years) for both an upright and an inverted version of the VET eye-tracking task. In this passive viewing task, participants viewed upright and inverted visual arrays, containing both social and nonsocial images. Visual attention was assessed between array types for a) perseveration: average length of time on an item; b) exploration: proportion of items explored; c) detail orientation: average number of discrete fixations; and d) duration: average length of an individual fixation.
Results: For upright arrays, participants with ASD displayed increased nonsocial detail orientation ($F = 7.4$, $p = .008$), a trend for increased nonsocial perseveration ($F = 3.02$, $p = .078$), and decreased social perseveration ($F = 3.7$, $p = .058$), exploration ($F = 17.1$, $p < .0001$), and duration ($F = 10.4$, $p = .002$) compared to TYP participants. For inverted arrays, ASD maintained increased nonsocial perseveration ($F = 4.6$, $p = .042$) and detail orientation ($F = 7.0$, $p = .038$), relative to TYP; however, the groups showed no differences for social variables (all $ps > .05$).
Conclusions: As expected, we found that inversion of images altered attentional patterns to social images in the TYP group but not the ASD group. Further, the nonsocial attentional bias pattern seen in participants with ASD was not impacted by inversion of the images. Overall this pattern of results suggests a robust nonsocial bias in ASD that may reflect enhanced motivation to view nonsocial images, even in a context where doing so is more difficult.

186 **164.186** Novel Methods to Assess the Contribution of Sensorimotor Mechanisms to the Presence of Motor Stereotypy in Autism Spectrum Disorders

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Background: The emergence of motor stereotypy is indicative of neural pathology in several neurodevelopmental and neuropsychiatric disorders including autism spectrum disorders (ASD); however, it is also present early in normative development during the transition from simple, uncontrolled movements to complex, controlled movements. Unlike in ASD, stereotypy in healthy infants begins to decrease within the first year of life and is replaced with goal-directed motor behavior. Research in normative development demonstrates the importance of sensory feedback for the development of motor complexity – as children develop the ability to integrate sensory information from the environment with motor behavior, their behavior becomes less stereotyped and more complex, allowing them to interact adaptively in the environment. This is consistent with our understanding of sensorimotor integration in the brain. Prior studies from our group have found that individuals with ASD who have motor stereotypy also have reduced motor complexity, consistent with the notion that motor stereotypy is a manifestation of low motor complexity. Additionally, individuals with ASD often present with unusual sensory symptoms suggesting that sensory processing deficits may contribute to the development of stereotyped actions.
Objectives: To date, the contribution of motor and sensory factors to the development of stereotyped behavior has only been examined in isolation. There is a need for methods that assess the joint sensory and motor contributions to the emergence of the core features of ASD. The purpose of this study is to develop a method for objectively measuring the role of sensory feedback on motor performance in ASD at the level of both brain and behavior.
Methods: We are adapting methods from studies of normative motor development to assess the effect of sensory feedback on motor complexity in individuals with ASD and relate these metrics to concurrent neural activity. Our method involves the use of virtual reality gloves that monitor hand position in real time and provide sensory feedback in the form of vibro-tactile stimulation. Participants perform a task during which they use their index finger to track a moving stimulus on a screen. For half of the trials, participants receive online vibro-tactile feedback at the fingertip if they deviate from the stimulus, and in the other half of the trials, they do not receive vibro-tactile feedback. Performance is measured using indices of complexity of movement kinematics (via accelerometers embedded in the gloves) and neural complexity (via electroencephalography). Here, we present preliminary results from this novel approach focusing on (a) method feasibility and test-retest reliability and (b) the application of nonlinear dynamic analytic techniques to examine coupling of neural and behavioral output during this sensorimotor task.
Results: N/A
Conclusions: N/A

187 **164.187** Olfactory and Social Impairments in Children with Autism Spectrum Disorders, Sensory Processing Challenges, and Typical Development

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Background:
Individuals with autism spectrum disorder (ASD) show atypical sensory processing within the olfactory system. Quantitative measures of olfaction, including detection threshold, identification, and discrimination, have yielded inconsistent results, yet there is mounting evidence that individuals with ASD perform more poorly than typically developing peers on these measures. In addition, the relationship between quantitative olfactory impairments and clinically assessed autism-related behaviors has not been studied, and may help to identify olfaction as a potential biomarker of ASD.
Objectives:
To assess olfactory performance in children with ASD, including smell detection thresholds and odor identification, to determine if olfactory measures can discriminate between ASD and an age and IQ matched clinical comparison group of children with sensory processing challenges (SPC), and to assess the relationship between olfactory performance and autism-related behaviors.
Methods:
14 children with high-functioning ASD (Age=10.36±1.68), 15 children with SPC (Age=10.25±1.62), and 14 typically developing children (TYP; Age=9.40±1.38) participated in this study. Two measures of olfactory processing were assessed. Odor detection thresholdÂ was measured using the phenyl ethyl alcohol version of the Sniffin' Sticks task. Smell identification was measured using the University of Pennsylvania Smell Identification Test (UPSIT). Autism severity was assessed using Module 3 of the Autism Diagnostic Observation Schedule (ADOS-2).
Results:
Children with ASD (M_{ASD}=24.07, SD_{ASD}=5.82) had significantly lower UPSIT scores than TYP children (M_{TYP}= 30.86, SD_{TYP}=3.61; t(26)= -3.71, p<.001), but no differences on the UPSIT were detected between children with ASD and SPC (M_{SPC}=27.73, SD_{SPC} = 5.19; t(27)= -1.79, p=.086) nor between children with SPC and TYP children (t(28)= -0.96, p=0.343). No difference in Sniffin' Sticks detectionÂ threshold was observed between the three groups (M_{ASD}=7.77, SD_{ASD}=4.13; M_{SPC}=8.15, SD_{SPC}=4.64; M_{TYP}=8.66, SD_{TYP}=4.09). UPSIT scores showed a negative correlation with ADOS 2 total score (r(41)= -0.48, p=0.001) and with the Social Affect domain of the ADOS 2 (r(41)= -0.49, p<.001) but no significant relationship was detected between UPSIT scores and the Restricted Repetitive Behavior domain of the ADOS 2 (r(41)= -0.27, p=0.084). Correlation analyses showed no significant relationships between Sniffin' Sticks detection thresholdÂ and ADOS 2 scores.
Conclusions:
Children with ASD showed reduced odor identification compared to typically developing children; however, in this preliminary sample, the two groups had similar odor detection thresholdÂ levels. In comparison to children with SPC, children with ASD showed similar odor identification and detection threshold levels. This finding suggests that the olfactory impairments observed in ASD may be specific to higher order olfactory processing but not unique to ASD. Both autism severity and social impairments were negatively associated with odor identification. The orbital frontal cortex (OFC) mediates odor identification and has also been implicated in social impairments; thus, impaired performance on this odor identification measure may be an especially useful quantitative biomarker of OFC involvement in children with ASD. We aim to validate the current preliminary findings with a larger sample, as data collection for this project is ongoing.


188 **164.188** Postural Control Assessment in Autism Using the Pediatric Balance Scale and the Fall Screen Assessment System: Results from a Pilot Study

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Background: Individuals with ASD have impairments in fine and gross motor skills, motor planning, motor coordination and praxis. A key sensorimotor control process affected by ASD is the management of upright standing. The maintenance of balance depends on the interaction of multiple sensory, motor and integrative systems (i.e. vestibular function, vision, peripheral sensation, muscle force and reaction time). A marked deficit in any one of these factors or a combination of mild impairments in multiple physiological domains may increase the risk of falling. Few studies on this topic are available in the literature and most of them have used just force platform instrumental approaches, neglecting the assessment of different balance components.
Objectives: The aims of this pilot study are: 1) to assess balance in a group of ASD subjects using the Pediatric Balance Scale (PBS), comparing the results with normative values; 2) to assess balance in the same sample, using the Fall Screen Assessment System (FSAS), comparing the results with a control group of normally developing children.
Methods: The study sample included nine ASD individuals and sixteen healthy age matched subjects. The ASD subjects were diagnosed with Autism according to the DSM V criteria, confirmed through ADOS 2 and under observation at our Institute. We employed: a) FSAS, a multi-item scale internationally validated in adult subjects, exploring sensorial and motor performances; b) PBS, a multi-item functional assessment tool exploring functional balance in the context of everyday tasks, commonly used in children and adolescents
Results: The two groups resulted homogeneous as regards age distribution (ASD group mean age 12.2 years - 4.29 SD vs control group mean age 12.8 years - 3.8 SD). We found that five (56%) ASD subjects showed a balance deficit as detected by the PBS (scores below the normality cut-off) and were also positive for the FSAS. Two more subjects were found at risk of falling only by FSAS. FSAS was easily applicable to children and adolescents and showed a statistically significant difference (p = <0.05) between the two groups in the following tests: visual contrast sensitivity, touch sensitivity, ankle dorsiflexion force, knee extension and flexion force, reaction time for hand, and all postural sway tests (table 1), thus evidencing an overall postural control impairment in ASD.
Conclusions:
This study confirms that ASD individuals are at major risk of falling in everyday life. This is attributable to an altered integration and elaboration of sensory and motor information. FSAS integrates the information derived from standard clinical assessment, and can be suggested as a complementary tool in the management of ASD. Moreover, by directly assessing an individual's physiological abilities, intervention strategies can be implemented to target areas of deficit. Further studies are necessary to confirm the results of this pilot study.

189 **164.189** Relationships Between Gross Motor Ability and Social Function in Young Children with Autism Spectrum Disorders

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Background: Autism spectrum disorder (ASD) is characterized primarily by social and communication impairments, however, children with ASD often exhibit additional delays in motor abilities. In children who are typically developing, motor ability is related to social function. However, the extent to which motor ability and social function and participation are related in children with ASD is unknown.
Objectives: The purpose of this study is to examine the relationship between gross motor ability and social function in young children with ASD. We hypothesize that children with ASD who have higher motor ability will also have higher social function.
Methods: Children with ASD between the ages of 48-71 were invited to participate in the study. All children were previously diagnosed with ASD by a physician. Diagnosis was confirmed by study investigators using the *Childhood Autism Rating Scales 2 (CARS2)*. The gross motor subscales of the *Peabody Developmental Motor Scales 2nd Ed (PDMS-2)*were administered to determine each participant's level of gross motor function. The PDMS-2 yielded scaled scores for each of the 3 subscales (Stationary, Locomotion, and Object Manipulation) and a standard score Gross Motor Quotient (GMQ). Social function was measured using the Social Skills Improvement System (SSIS). The SSIS provided an overall standard score for 2 scales: Overall Social Skills and Problem Behaviors.
Results: Six children with ASD have participated in the study thus far.Â We expect to have data from at least 20 participants at the time of the conference in May.Â Participants ranged from 49 to 65 months of age (Mean=56.33 mths). Five children scored in the Mild to Moderate category of the CARS2 while the remaining child scored in the Severe category. Four children demonstrated delayed gross motor skills on the PDMS-2 as indicated by a GMQ <1.5 SD below the mean. Spearman's rank-order correlation revealed a strong, positive relationship between PDMS-2 GMQ and SSIS Overall Social Skills standard scores (r_s=0.829, p=.042). Further analysis revealed significant relationships between the Locomotion (r_s=0.939, p=.005) and Object Manipulation (r_s=0.928, p=.008) subtests of the PDMS-2 with the SSIS Overall Social Skills standard scores. No significant correlations were found for the SSIS Overall Social Skills and PDMS-2 Stationary scales (r_s=.679, p=.138) or the SSIS Problem Behaviors and PDMS-2 GMQ (r_s=-.200, p=.704).
Conclusions: The results thus far support previous findings that suggest that gross motor delays are common in children with ASD. In addition, a positive relationship between gross motor ability and social function was found. Areas of gross motor skills that may be related to social skills are Locomotor skills such as jumping, running, and stair climbing and Object Manipulation skills such as throwing, catching, and kicking a ball. Further research is needed to quantify these relationships and pinpoint exact areas of concern regarding motor skills in young children with ASD.

190 **164.190** Repetitive Behavior and Object Exploration in Young Autistic Children: How Are They Associated?

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Background: An often-repeated but questionable claim about repetitive behaviors in autism is that they interfere with learning. More specifically, increased repetitive behaviors are thought to reduce exploration of the environment in autistic children, thus reducing opportunities for learning (Pierce & Courchesne E., 2001; Sasson et al., 2008, for a review). However, using the Montreal Stimulating Play Situation (MSPS), we found that young autistic children displayed significantly more repetitive behaviors than age-matched typical children, but the two groups of children did not significantly differ in their exploration of objects (Jacques et al., 2016). Our previous findings did not seem to support the prevailing view, but did not address how or whether repetitive behavior is associated with object exploration in autistic and typical young children.
Objectives: Building on our previous findings, and within the same sample of children, to determine whether repetitive behaviors and object explorations (their frequency and duration) are associated in young autistic children; and to determine whether these associations are similar to or different from those found in age-matched typical children.
Methods: 49 autistic (mean age=47.1 months, SD=10.49; mean MSEL=63.7, SD=19.14) and 43 typical (mean age=42.8 months, SD=13.65, p=.09; mean MSEL=110.7, SD=16.9, p<.001) children were assessed with MSPS. Four play periods (one free-play, one semi-free play, one semi-structured play, and a second free-play period) including 34-40 objects of potential interest to autistic children were filmed. Two naïve typical raters coded duration (in seconds) and frequency (number of occurrences) of repetitive behaviors and object explorations on Observer XT 11©. Correlations between repetitive behaviors and object explorations were calculated for autistic and typical groups for the full MSPS (4 correlations), and for each play period (16 correlations).
Results:
For the full MSPS, in typical children, frequency of repetitive behaviors was significantly and positively correlated with frequency of object explorations (r=.336, p=.028), but this was not the case for autistic children, where no significant correlation was found (r=.146, p=.32). Similarly, duration of repetitive behaviors was significantly and positively correlated with duration of object explorations in typical (r=.358, p=.018) but not autistic (r=.058, p=.69) children. The difference between groups was significant for duration (p=.028) but not for frequency (p=.35) correlations.
For the 4 MSPS play periods, correlations were either significantly positive (5 for autistic and 4 for typical children) or not significant (the remaining 7). Significant positive correlations were weak to moderate (r=.296 to .564). There were no significant negative correlations.
Conclusions: Across the full MSPS, we found weak but significant positive correlations between repetitive behaviors and object explorations in young typical children, such that increased repetitive behavior was weakly associated with increased object exploration. No significant correlations were found in age-matched autistic children, who in this sample displayed significantly more repetitive behaviors than their typical controls. Within individual MSPS play periods, some significant positive correlations were found in both groups. However, we found no significant negative correlations. We found no evidence that repetitive behavior reduces or interferes with object exploration in either autistic or typical young children.

191 **164.191** Repetitive Behavior and Restricted Interests of Offspring in Adults with ASD and Other Neuropsychiatric Disorders

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Background: The broader autism phenoptype (BAP) is an emerging construct suggesting that first-degree relatives of those diagnosed with autism spectrum disorders (ASD) exhibit behaviors that encompass the ASD spectrum without necessarily reaching diagnostic thresholds for clinical disorder. Generally the BAP refers to behaviors of parents or "unaffected" siblings of children with ASD. Some aspects of the BAP are relevant to other disorders as well. Repetitive Behaviors and Restricted Interests (RBRI) for example not only define ASD (and the BAP) but they also appear in a wide range of other neurodevelopmental and neuropsychiatric disorders, including, but not limited to, obsessive-compulsive disorder (OCD), tic disorders, intellectual and developmental disabilities, and psychotic disorders. What is not well understood is the manifestation of RBRI in the offspring of adults diagnosed with these disorders, as well as (high functioning) ASD. We know virtually nothing, about the trajectory of RBRI in children who are at risk for various neurodevelopmetnal and neuropsychiatric disorders, by virtue of parental diagnostic status.
Objectives: To examine the frequency/intensity, as well as the cross-sectional trajectory, of RBRI in offspring of adults diagnosed with a range of neurodevelopmental and neuropsychiatric disorders who represent a nationally-representative cohort.
Methods: 2897 adults who were ascertained from a representative United States cohort of adults with at least one children ranging in age from 1-17;11 years of age. Families were sent an online battery of surveys indicating demographic status including clinical neurodevelopmental and neuropsychatric diagnostic family history. Parents also completed the Childhood Routines Inventory-Revised (CRI-R) to assess Total RBRI, Repetitive Motor Behaviors/Compulsions (RMBC), and Resistence/Insistence on Sameness (RIS). Parents were grouped into several diagnostic clusters basad on their psychiatric history: ASD (n=38); OCD/tic disorders (n=66); bi-polar/schizophrenia (n=157); no diagnosis (n=1914); "other" diagnosis (n=738). Children were placed into one of three age groups (1-6 years, 7-12 years, 13-17;11 years).
Results: A 4 (parent diagnosis) X 3 (age group) analysis of variance revealed a significant interaction for RMBC ($F(2882,8)= 2.08$, $p= 0.03$), main effects for parent diagnosis for all three CRI-R factors (All $p < 0.0001$), and main effects for age group for Total CRI-R ($p = 0.03$) and RMBC ($p= 0.02$).
Conclusions: The offspring of adults with an ASD demonstrated signficantly higher RBRI relative to all other diagnositic groups, followed by OCD/tic disorders, bi-polar/schizophrenia, any other diagnosis, and no diagnosis. Children of parents with ASD had unique developmental trajectories that indicated progressive age effects across all three age groups, whereas all offspring of all other parental diagnostic groups showed a characteristic increase from agegroup 1 to agegroup 2, with a decrease for age group 3. These data indicate that the frequency/intensity and developmental trajectories of RBRI in children are impacted by parental diagnostic status.

192 **164.192** Repetitive and Restricted Behaviors and Their Sensory Components in Young Children with ASD: Family Quality of Life and Improvement during Intervention.

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Background:
Sensory processing issues (SP) often co-occur with restricted and repetitive behaviors (RRB). Following a developmental account RRBs are defined as developmentally immature responses serving adaptive functions (occupying self versus soothing) to arousal derived from sensory processing issues. Alternative considerations account for sensory processing issues as primary impairment resulting in interaction problems typical for ASD. Comprehensive programs intervene directly on RRBs defined as barriers for learning more mature responses from social experience.
Objectives:
Examine associations of SP and RRB and whether social deficits account for any relationship. Explore their impact on family's Quality of Life and potential change during behavioral treatment.
Methods:
Sixteen parents of preschoolers with ASD who received EIBI intervention provided ratings of Quality of Life (WHOQOL-BREF, WHOQOL Group, 1998) and child characteristics (Restricted and Repetitive Behaviors Scale, Bourreau et al., 2009; Short Sensory Profile, Dunn, 1999). Evaluation of autism core symptoms (ADOS-2, Lord et al., 2012) and developmental cognitive level (GMDS-R, Luis et al., 2006) was provided by external licensed neurodevelopmental psychiatrists.
Results:
Fourteen children (87.5%) demonstrated an probable or definite difference in SP. Strongly associated SP and RRB scores confirmed lower-level clusters of repetitive sensorimotor behaviors and sensorimotor stereotypies ($r=-.639$, $p>.001$ to $r=-.570$, $p>.05$), associated with lower cognitive level ($r=.771$ to $r=.,587$ $p>.05$), and a higher-level cluster of insistence on sameness/modulation insufficiency and sensory seeking /auditory filtering ($r=-.590$ to $r=.508$, $p>.05$). No association was found of ADOS social communication and presence of repetitive behaviors or sensory processing issues. Family QOL was impacted by lower cognitive level ($t=3.695$, $p>.05$) and atypical sensory processing of movement ($t=3.543$, $p>.05$), tactile ($t=5.216$, $p>.01$), visual ($t=4.175$, $p>.05$) stimuli and inattention due to auditory filtering issues. Family QOL was not predicted by age, autism severity or repetitive behavioral representations alone. The full model explained 85% of variability. At six months of intervention SP ($t=-7.001$, $p>.0001$) and RRB ($t=4.759$, $p>.001$) were reduced at a rate of 19% in frequency of case occurrence, with 11 remaining children (68%) demonstrating a difference in SP. Subscale analyses revealed improvement predominantly in under-responsiveness, and distractibility with decline in behavioral representations such as adoption of control, rituals, object attachment, and echolalia. Magnitude of improvement was significantly associated with social communication severity ($p>.01$).
Conclusions:
Results confirm clusters of lower- and higher-order repetitive behaviors, differentially associated with cognitive impairment. This pilot is novel in demonstrating the negative impact of Sensory processing issues on family Quality of Life as well as the efficacy of comprehensive intervention in reducing repetitive behaviors and correlated sensory issues. The present results did not support the assumption of a social-communication dysfunction as a shared mechanism that underlines SP and RRBs. Nevertheless, social-communication deficit was shown to impact the rate of improvement. It is reasonable that decreasing engagement in repetitive behaviors may make the child more amenable to treatment targeting autism core symptoms.

193 **164.193** Restricted Repetitive Behaviors and Interests and the Female Autism Phenotype: An Autism Speaks Autism Treatment Network (AS-ATN) Study.

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Background: Autism Spectrum Disorder (ASD) continues to be diagnosed at a greater rate in males than in females with current prevalence rates estimated at 4-5:1 (males; CDC, 2016). Although clinical characteristics of ASD manifest differently in males and females (e.g. Bölte et al, 2011; Carter et al, 2007), few studies have investigated sex differences in ASD's two core domains: social–communication and restricted, repetitive behaviors, interests and activities (RRBs). Additionally, compared to the social-communication domain, considerably less is known about the cause, development and impact of RRBs in children with ASD, including possible sex differences.
Objectives: The aim of this study is to examine potential differences in clinically identified (ADOS) RRB symptoms using a large sample of age and IQ-matched females and males with ASD.
Methods: Data were extracted from the Autism Speaks Autism Treatment Network (ATN) registry. The study sample included 513 females and 513 males with **an ASD diagnosis (Autistic Disorder, Asperger's Disorder)** propensity score-matched 1:1 on age in 24mo intervals and IQ (≥70 vs. <70). Age (<6 yrs, 6-<12 yrs), race, ethnicity, IQ, caregiver education, evidence of lost skills, and autism diagnosis were tabulated overall and by sex. Fisher's exact tests evaluated if these characteristics differ by sex. ADOS RRB domain calibrated severity score and its individual items were described overall and by sex in four age-IQ groups: 1. IQ≥70 and < 6 yrs, 2. IQ≥70 and 6-<12 yrs, 3. IQ<70 and <6 yrs, 4. IQ<70 and 6-<12 yrs. T-tests assessed whether RRB differs by sex within each of these groups. Means and standard deviations were reported. RRB individual item scores (1 or 2 vs. 0) were tabulated by sex, and Fisher's exact tests determined if these items differ by sex.
Results: Demographic characteristics, evidence of lost skills, or ASD diagnosis did not differ significantly by sex (see Table 1). RRB total score differed by sex (p=0.022) in the IQ<70-age 6-<12 group, with females reporting lower RRB than males, but no significant sex differences were found for other groups. In the IQ≥70-age<6 group females had a higher percentage of abnormal hand/finger/other complex mannerisms (p=0.038) and abnormal intonation of vocalizations or verbalizations (p=0.049). In the IQ≥70-age 6-<12 group females also had a higher percentage of abnormal hand/finger/other complex mannerisms (p=0.037; see Table 2). No item scores differed significantly by sex in either of the IQ<70 groups.
Conclusions: Â Findings from the largest dataset to date of matched young females and males with ASD indicate that there are sex differences in overall RRBs and in particular sub-domains for selected groups. These differences add to the growing literature regarding the need for sex-specific algorithms in autism diagnostic instruments which may then help improve our ability to identify misdiagnosed and under-diagnosed females with ASD.

194 **164.194** Restricted and Repetitive Behaviors and Interests Differ By Sex and Age in High Functioning Children with ASD

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Background:
Restricted and repetitive behaviors and interests (RRBs) are a core feature of Autism Spectrum Disorders (ASD) required to meet diagnostic criteria for ASD according to the DSM-5. Research suggests RRBs are a heterogeneous group of behaviors with subtypes having differential developmental trajectories. Patterns of findings across studies are not consistent regarding age-related changes in RRBs. Understanding the developmental trajectory of RRB subtypes in girls and high functioning children and adolescents has implications for better understanding symptom progression across the ASD spectrum.
Objectives:
Data are from a multi-site study focusing on multimodal neurogenetic exploration of girls (and boys) with ASD. In a sample of children with ASD without intellectual impairment, we explore the effects of child age and gender on parent report of RRBs in three domains: stereotyped, ritualistic, and restricted behavior.
Methods:
Preliminary data were analyzed from a sample of children who participated in the NIMH ACE network GENDAAR study, across 4 U.S. research sites. In order to analyze the influence of child gender, we matched a subsample of 40 ASD males and 40 ASD females on age (8-17 years) and IQ (mean IQ=102.95, SD=22.47). Subjects were divided into 2 cross-sectional age groups: 8-12.9 years (children) and 14-17.9 years (adolescents). Parents completed the Repetitive Behavior Scale – Revised (RBS-R) about their child. All subjects met diagnostic criteria for ASD on the ADOS-2 and the ADI Revised. Final analyses will include additional subjects and measures of RRBs.
Results:
On the stereotyped behavior subscale, male children (M=4.55, SD=3.561) scored significantly higher (worse) than male adolescents (M=1.20, SD=1.240) (p=.001), while girls' stereotyped behavior scores did not differ across age groups (p=.106). On the ritualistic behavior subscale, male children (M=5.25, SD=4.587) scored significantly higher (worse) than male adolescents (M=2.50, SD=2.439) (p = .025), however girls' ritualistic behavior scores did not differ across age groups (p=.528). On the restricted behavior subscale, males' scores (M=3.50, SD=3.211) were also significantly higher (worse) than females' scores (M=2.13, SD=2.127), regardless of age group (p=.026).
Conclusions:
In our sample, male children scored higher (worse) than male adolescents on measures of stereotyped and ritualistic behaviors. In contrast, females' scores on stereotyped and ritualistic behaviors did not differ between age groups. Additionally, males scored higher (worse) than females on restricted behaviors. These findings suggest that the level of RRBs in ASD may vary based on age *and*gender, with males showing (overall) higher (worse) scores. Age and gender may be important factors in the developmental trajectory of RRBs in children and adolescents with ASD without intellectual disability.

195 **164.195** Restrictive and Repetitive Behaviors and Interests and Inhibitory Control in Children with Autism Spectrum Disorder

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Background: Deficits in executive functioning (EF), an ability that encompasses inhibition, planning, attention regulation, set-shifting and working memory, have been observed in children with autism spectrum disorders (ASD) (Ozonoff, Pennington, & Rogers, 1991; Pellicano et al., 2006). Poor inhibitory control has been implicated in the maintenance of the inappropriate (i.e. nonadaptive) thoughts and behaviors distinctive of ASD, termed restrictive and repetitive behaviors and interests (RRBIs) (Turner 1997; 1999). This characteristic can be subdivided into two correlated yet qualitatively different categories: Insistence on Sameness (IS) and Repetitive Sensory Motor (RSM) behaviors (Turner, 1999; Somer et al., 2013) and conceptualized as higher-order (including preoccupations and ritualistic behavior) and sensorimotor, respectively (Mosconi et al, 2011; Turner, 1999). RRBIs generally, and higher-order RRBIs specifically, have been related to inhibitory control in individuals with ASD with mixed results (Lopez et al., 2005; Mosconi et al. 2009). In the present study, inhibitory control and phenotypic variation in RRBIs were examined in 64 high-functioning children with ASD.
Objectives: To determine whether variation in RRBIs relates to impaired inhibitory control in a Stroop task in children with ASD.
Methods: 64 children with ASD between the ages of 7- and 12-years-old were included in analyses. All children had a full-scale IQ above 85. Children participated in the Autism Diagnostic Observation Schedule (ADOS-2) and parents completed survey and interview measures about their child, including the Repetitive Behavior Scale-Revised (RBS-R) and Autism Diagnostic Interview-Revised (ADI-R). Children's behavioral responses were recorded during a computer-based Stroop task. Stroop difference scores were computed from accuracy scores on incongruent and congruent trials, with larger difference scores indicating a failure to inhibit a learned verbal response. Children's inhibitory control in the Stroop task was analyzed with parental reports of RRBIs on the ADI-R and RBS-R, and researcher ratings of RRBIs during the ADOS-2. Higher-order RRBI scores were computed from subscale items on the ADOS-2, ADI-R, and RBS-R.
Results: Correlations between higher-order RRBI scores on the ADI-R and RBS-R and Stroop difference scores were not significant, however higher-order scores on the ADOS-2 were positively correlated with Stroop difference scores ($r = .292$, $p = .019$). A linear regression controlling for age and verbal IQ found a significant relationship between higher-order ADOS-2 RRBIs and Stroop difference scores ($R^2_{change} = .075$, $t(62) = 2.27$, $p = .027$). No relation was found between global RRBI subscales from the ADOS-2, ADI-R, or RBS-R and Stroop performance.
Conclusions: RRBIs were inconsistently related to inhibitory control; however findings suggest readily observable higher-order RRBIs (e.g. via the ADOS-2) may be more indicative of children's current inhibitory skills than parental reports. Analysis of participants' behavioral and electrophysiological responses to a Go-No-Go task is ongoing and will allow further examination of inhibitory control as it relates to RRBIs. Given the significant interference of RRBIs in everyday functioning, computer-based EF training may be an efficacious and desirable intervention for reducing higher-order RRBIs through improved inhibitory control.

196 **164.196** Selective Impairments in Action Understanding and Movement Intentionality in Young Children with Autism When Compared to Williams Syndrome

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Background: Although previous studies comparing Autism spectrum disorder (ASD) and Williams syndrome (WS) have focused on the social and motor domains separately, recent theoretical perspectives on “motor cognition” have proposed that the motor system is fundamentally intertwined with social functioning. Despite the simplistic view of opposing abnormalities in social behavior, with ASD characterized by hyposociability, and WS exhibiting hypersociability, there are striking similarities in motor dysfunction across these two syndromes. Yet, the extent to which ASD and WS share common deficits in the encoding of others’ motor intentions and movement interference, which are critical motor mechanisms impacting on social functioning, is as yet unexplored. Direct cross-syndrome comparisons of young children with ASD and WS provide a hitherto unprecedented opportunity to examine specificity of motor mechanisms impacting on cognitive and adaptive social functioning.
Objectives: Here we compare the ability to understand and predict others’ intentional actions and movement interference in preschoolers with ASD when compared to a matched sample of children with WS, and typically developing (TD) children. Specifically, we aimed to identify whether deficits in encoding motor intentions and movement execution during incongruent actions are specific to ASD, and explore the extent of association with cognitive and social functioning.
Methods: Using novel experimental behavioral and eye tracking tasks that were video-recorded, we examined childrens’ movement interference when observing a models’ incompatible actions and their understanding of the intended goal of reaching actions across the following conditions: 1) observation of a model performing either congruent or incongruent actions (e.g. placing coins in a moneybox, stacking rings in correct order), 2) coding of childrens’ movement efficiency (time and effective actions) during incongruent versus congruent conditions, and (3 patterns of anticipatory looking to a target during successful or failed attempts by a model to reach over a barrier to retrieve it.
Results: Preliminary findings suggest that children with ASD showed significantly reduced movement interference time during incongruent relative to congruent actions when compared to TD children. Interestingly, reduced movement interference during action observation correlated with greater severity of symptoms in social affect and restricted repetitive behavior in ASD. Although there were no group differences in anticipatory fixations or duration to goal-directed reaching actions, less anticipatory fixations to the target correlated with greater severity of autism symptoms in children with ASD.
Conclusions: Our findings add to the growing evidence base supporting a critical role for motor system dysfunction contributing to difficulties in the social domain in young children with ASD. Direct cross-syndrome comparisions will be important in revealing autism-specific impairments in motor cognition which may lead to new treatment targets for core ASD symptomatology.

197 **164.197** Sensory Experiences of Adults with ASD and Severe and Complex Needs: A Qualitative Study with Practitioner Informants

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Background: It is well established that individuals with Autism Spectrum Disorder (ASD) report unusual sensory experiences (e.g. Smith & Sharp, 2013; Robertson & Simmons, 2015). However, previous research has focused mainly on the sensory experiences of children and verbal adults with ASD and has relied heavily on self-report and parent-report measures: methods with obvious limitations. In this study we focused instead on adults with ASD and severe and complex needs who find it difficult to communicate their own perceptual experiences accurately. In order to access this population, we collected reports from autism practitioners, using semi-structured interviews.
Objectives: To assess whether there are quantitative and/or qualitative differences in the nature and severity of the sensory experiences of adults with ASD and severe and complex needs as opposed to those with typical IQ levels.
Methods: 19 adult autism practitioners were interviewed about their experiences with autistic adults with severe and complex needs. Questions in the interviews used a variant of the Critical Incident Technique (Flanagan, 1954; Dickie et al, 2009) to evoke a more objective analysis of witnessed incidents where there had been clear sensory triggers. Transcripts of the interviews were analysed using Thematic Analysis (Braun & Clarke, 2006).
Results: Many of the responses reported a familiar combination of hyper- and hypo-sensitivities combined with sensory seeking behaviour across all the senses, with a slightly higher frequency of (mainly negative) auditory experiences. Particularly graphic descriptions were given of individuals who maintained pressure on their bodies throughout the day by wearing tight clothing, an individual who was apparently bothered by the humming noise from a fluorescent light, outside the hearing range of the practitioners, and another who was particularly disturbed by visual clutter. Some, however, were less familiar, such as sensory seeking of loud noises like drilling, and of high temperatures by touching hot kettles and toasters. A striking quantitative difference found in these data were the extreme reactions either to avoid or reduce unwanted sensory stimulation or to obtain desired stimulation.Â Examples included “challenging behaviour” like throwing furniture, or running across a busy street to obtainÂ a snack packet, the rustling noise of which was a desired goal.
Conclusions: It appears from our unique and rich data set that the clear sensory features experienced by adults with ASD and severe and complex needs are largely similar in nature to those reported by adults with ASD and typical IQs, with a few fascinating exceptions. However, the most remarkable difference is in the more extreme apparent reactions to both pleasant and unpleasant sensory triggers. Arguably, therefore, sensory “reactivity” is a useful term to have in descriptions of sensory features in ASD. It should also be noted that the combination of experience and relative objectivity on the part of our practitioner participants has provided a valuable extra dimension when investigating the behavioural phenotype of this enigmatic condition, and can be usefully used as an integral part of practitioner training as well as future research.

198 **164.198** Sensory Hypersensitivity and the Predictability of Repetitive Behaviours in Autism Spectrum Disorder

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Background: Repetitive behaviours (RBs) are a core diagnostic symptom of Autism Spectrum Disorder (ASD) and tremendously impact individuals' day-to-day lives, yet the underlying factors of RBs are not fully understood. Recent work suggests that sensory issues related to ASD, specifically sensory sensitivities, contribute to RBs. While these studies have provided evidence for a relationship between RBs and hypersensitivity in individuals with ASD, these studies have not (1) identified if this relationship is specific to a particular sensory modality, nor (2) included adequate control groups to test if this relationship is specific to ASD.
Objectives: (1) Determine if hypersensitivity in specific sensory modalities contributes to the presence and severity of RBs. (2) Compare the relationship between sensory sensitivity and RBs in children with and without ASD to examine whether this relationship is specific to ASD.
Methods: Parents of 70 children (ASD, n=38; TD, n=32) completed questionnaires reporting on sensory processing (Sensory Profile-2, SP-2), and RBs (Repetitive Behaviours Questionnaire-2; Repetitive Motor Movements subscale). Cognitive ability was tested and matched using the Wechsler Abbreviated Scale of Intelligence–2 (WASI-II). A two-step analysis was employed. First, correlational analyses were conducted to identify relationships between sensitivities in individual sensory modalities in TD and ASD. Second, hierarchical regressions were conducted to examine the unique contributions of sensory sensitivities while controlling for demographic variables.
Results: Correlations confirmed a strong relationship between the RBs and the Sensitivity/Sensory Subscale of the SP-2 not only in ASD ($r^2=0.3133$, $p<0.001$), but also in TD ($r^2=0.1621$, $p=0.022$). The relationship between RBs and processing in individual sensory modalities, however, differed between groups. In ASD, we found that RBs significantly correlated with each individual sensory modality, including audition ($r^2=0.1812$, $p=0.010$), vision ($r^2=0.1698$, $p=0.013$), and touch ($r^2=0.3206$, $p<0.001$). In TD, however, only audition showed a significant correlation ($r^2=0.3154$, $p=0.002$), not vision or touch ($ps>0.05$). Hierarchical regressions revealed that sensory sensitivities were predictive of RBs even when controlling for age, gender, and intelligence in both ASD ($p<0.001$) and TD ($p=0.034$) groups. Similar to the correlation findings, in TD, the main driver of RBs was auditory sensitivity ($p=0.031$). In the ASD group, however, touch was identified being the most predictive of RBs ($p=0.015$).
Conclusions: These data provide evidence that hypersensitivity contributes to RBs in individuals with ASD, but also suggest that this relationship is not restricted to ASD, but is seen in TD as well. Although hypersensitivity relates to RBs in both ASD and TD, exacerbated levels of hypersensitivity in ASD resulted in more severe RBs that surpassed a clinical threshold. While similarities were observed in the overall relationship between sensory sensitivities and RBs, this correlation was apparent across modalities in ASD, but limited to audition in TD. Furthermore, results of the hierarchical regression suggest that in ASD but not TD, sensitivity to touch is particularly predictive of RBs. In sum, these results suggest that (1) sensory sensitivities are strongly related to RBs in individuals with and without ASD, but (2) the pattern of these relationships across sensory modalities diverge between groups.

199 **164.199** Sensory Processing, Repetitive Behaviours and Anxiety in Autism Spectrum Disorder and Williams Syndrome

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Background: Unusual sensory responses are common in autism spectrum disorder (ASD) and have been included in the diagnostic criteria for the disorder, alongside social communication and interaction difficulties. Sensory difficulties, are also common amongst individuals with other neurodevelopmental disorders, including Williams syndrome (WS). Interestingly, both disorders although with different aetiology and presentations, share not only psychopathology relating to sensory processing, but also repetitive behaviours and anxiety. The associations, however, within and between these features are still not well understood and the degree of the co-occurrence and syndrome-specificity is still not well characterised.
Objectives: The aims of this study were: (a) to examine and compare the features of sensory processing clusters in children with ASD or WS; (b) to investigate whether sensory processing based clusters differed according to levels of anxiety and repetitive behaviours in children with ASD or WS.
Methods: Parents of 17 children with ASD and 16 with WS, aged between 4 and 9 years were recruited. Parents were asked to complete the Sensory Profile to provide information about their children's sensory experiences, the Social Responsiveness Scale (SRS-2) to assess a degree of social impairment, the Spence Children's Anxiety Scale/Preschool Anxiety Scale (SCAS/PAS) and the Anxiety Scale for Children-ASD (ASC-ASD) to assess anxiety symptoms, and the Repetitive Behaviour Questionnaire to evaluate the severity or frequency of repetitive behaviours that the children were engaging in.
Results: Â A hierarchical agglomerative cluster analysis was performed in order to identify subgroups based on sensory characteristics (Low Registration, Sensory Sensitivity, Sensation Seeking, Sensory Avoiding). A two-cluster solution emerged as the best fit to the data when the total sample was entered and also when ASD and WS groups were entered separately. Cluster 1 was represented with a low frequency of sensory behaviours and (2) cluster with a high frequency of sensory behaviours. A MANOVA showed a significant cluster effect for total repetitive behaviour score and both subscales (repetitive sensory motor behaviours and insistence on sameness; $F(3,27)=6.56$, $p=.002$).Â In addition the clusters differed on all total and subscale anxiety scores (SCAS/PAS scores $F(6,24)=4.10$, $p=.006$; ASC-ASD $F(4,23)=3.64$, $p=.019$). Univariate analysis indicated that parents of children in cluster 2 reporting significantly more repetitive behaviours and higher levels of child's anxiety than parents of children in cluster 1. However, when the SRS-2 total score was controlled for only the effect of cluster on anxiety remained significant for the SCAS/PAS scores in the total sample $F(6,23)=2.74$, $p=.037$.
Conclusions: The findings suggest that sensory profiles in children with WS or ASD are similar and that sensory processing atypicalities are associated with higher levels of anxiety and repetitive behaviours in both disorders. However, differences in severity of autistic traits contribute to the higher presentation of repetitive behaviours and anxiety in those children with ASD and WS who have greater sensory difficulties. Further work is needed to explore the role of other possible factors (e.g. intolerance of uncertainty) in the presentation of sensory atypicalities, repetitive behaviours and anxiety in neurodevelopmental disorders.

200 **164.200** Sensory Responsiveness in Siblings of Children with Autism

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Background:
Although autism spectrum disorder (ASD) is known to be heritable, the patterns of endophenotypic trait occurrences (inherited traits associated with a particular diagnosis that manifest in family members who do not have the diagnosis) are not well understood. Endophenotypes have emerged as an important concept to help clarify genetic underpinnings of complex neuropsychiatric conditions and to provide insight into underlying etiologies. Evidence has identified several endophenotypic traits, including social impairment, Reduced GABA/Cr (Creatine) matter, whole brain functional hypoconnectivity, visual motion perception, atypical frontal activation during visual attention and immunological functions. Children with ASD have been shown to demonstrate unusual sensory responses to stimuli more frequently than do typically developing peers or those with other developmental disorders.
Objectives:
This study examined sensory responsiveness in unaffected siblings of children with ASD and associations between sensory responsiveness and social severity. Questions addressed were: (a) Do unaffected siblings of children with ASD exhibit atypical sensory responsiveness? and (b) Is sensory responsiveness related to social responsiveness in unaffected siblings of children with ASD?
Methods:
185 children between ages 4 and 10.95 years participated in this study, 113 with ASD, 33 unaffected siblings, and 39 controls. Sensory Profile
Caregiver Questionnaires and Social Responsiveness Scales were completed by parents. A Kruskal Wallis ANOVA was used to examine the differences between the sensory response scores. To quantify the size of the variances, we examined the effect sizes in the children with ASD and the unaffected siblings and compared them to the control participants. Because of multiple comparisons, we used a Bonferroni correction to reduce the chances for a Type 1 error. We used a post-hoc Mann Whitney U test with a Bonferroni correction to locate significant differences. Correlations between the severity and the sensory Z scores were examined using the Spearman's rank correlation coefficient test.
Results:
The ASD affected participants had a wide range of sensory scores, while many of the unaffected siblings and controls had a preponderance of scores in the most typical end of the range. This contributed to reduced correlations between sensory and social responsiveness scores among these groups. Significant differences were found betweenÂ participants with ASD and controls, and between participantsÂ with ASD and unaffected siblings for all sensoryÂ quadrants and domains, but not between controls andÂ unaffected siblings. Social responsiveness scores were significantly correlated with scores from most sensory profileÂ categories. Repetitive behaviors were more frequently associated with sensory responsiveness than the other social responsiveness categories.
Conclusions:
Sensory responsiveness as an endophenotype ofÂ ASD is not indicated from these findings; however, studies with larger numbers of unaffected siblings and controls are needed to confirm the null hypothesis. Touch and taste/smell were the domains most frequently associated with social responsiveness, suggesting the possibility that they may bear some responsibility in social responsiveness problems and may be important targets for intervention for these problems. Finding repetitive behaviors to be frequently associated with sensory responsiveness suggests a relationship between the two and the potential for interventions addressing sensory problems to have an impact on repetitive behaviors.

201 **164.201** Sex and IQ As Predictors of Sensory Patterns in ASD

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Background:
Females are underrepresented in ASD, which is possibly influenced by the male-bias in the population. Furthermore, females are diagnosed at a later age preventing them from accessing essential services at earlier stages of development. Little is known about the underlying differences in ASD symptoms between females and males, specifically the manifestation of sensory response patterns. These sensory responses, including hypo-responsiveness (HYPO), hyper-responsiveness (HYPER), and seeking behaviors (SEEK) impact the child's language, adaptive skills, and overall quality of life. Additionally, recent findings suggest that IQ is negatively correlated with increased sensory responses. Previous studies of sensory responses in children with ASD have not included a sufficient number of females to adequately examine potential sex differences.
Objectives:
This study aims to examine sex and IQ as predictors of sensory response patterns in children with ASD.
Methods:
This study used extant data from a large longitudinal study. Caregivers of children with ASD aged 2-12 years old (n=1307) participated in a national online survey examining longitudinal outcomes of sensory behaviors. The national survey study collected data at two time points, but only time point 1 data were analyzed in the current study. The survey included a background questionnaire (including parent report of cognitive functioning converted to a proxy IQ; IQP) and the Sensory Experiences Questionnaire (SEQ.v3). Only children that had a reported IQP were included in the analysis (females n=196 and males n =929). A regression model was employed to examine sex and IQP as predictors of sensory patterns.
Results:
Sex was found to be a significant predictor of HYPO ($p < .025$) and SEEK ($p < .048$), but not HYPER ($p < .40$). Moreover, there was an interaction between sex and IQP ($p < .015$) indicating that females with lower IQP scored higher on HYPO behaviors than males at the same level of IQP. However, with higher IQP levels, males scored higher on HYPO behaviors than females. A similar pattern was found with SEEK ($p < .010$) where females with lower IQP had more seeking behaviors than males, but as IQP increased, males scored higher on SEEK behaviors in comparison to females. IQP had a significant correlation with HYPER ($p < .025$), indicating that children with higher IQP show more sensory hyper-responsiveness, but sex was not significantly associated with HYPER.
Conclusions:
This novel study investigated sex differences in sensory response patterns in children with ASD. These results provide important insight on understanding sensory behaviors in females across different levels of IQP, suggesting that females with lower IQP tend to have more HYPO and/or SEEK behaviors than their counterpart males. In contrast, females with higher IQP show less HYPO and/or SEEK than males with comparable IQP. These findings have implications for diagnosis and intervention that reflect the unique sensory differences between the sexes.

202 **164.202** Standing Balance on Rigid and Unstable Surfaces in Children on the Autism Spectrum: Interaction Between Symptom and Motor Domains

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Background:
Difficulty with postural stability during standing on stable surfaces has been reported in people on the autism spectrum (see Memari et al. [2014] for review). However, it is unclear whether unstable surfaces may present even more of a challenge to youth with autism spectrum disorder (ASD). Because much of the ground on which we balance has the potential to be unstable, it is important to understand standing balance on both rigid and unstable surfaces. Further, it is important to understand individual differences that might relate to more severe postural stability challenges in ASD.
Objectives:
1) To examine postural stability in youth on the autism spectrum compared to youth with typical development during standing on a traditional rigid platform compared to a tiltable platform, and 2) to examine whether postural stability measures are related to individual variation in social communication and repetitive behavior symptom severity.
Methods:
Twenty youth on the autism spectrum and 18 youth with typical development (ages 6-16 years, IQ>70, 89% male) stood on both a rigid and tiltable platform that recorded force and center of pressure. Postural sway area and total mean velocity were calculated and served as the primary measures of postural stability. Postural stability was then examined as a correlate of autism symptom severity (RBS-R, SCQ, and SRS). To determine if individuals with ASD exhibited poorer postural stability than individuals with typical development on a rigid versus unstable platform, we conducted a linear mixed-effects analysis to examine the effect of surface condition (rigid versus unstable surface), group status (ASD versus typical development), and FSIQ on postural stability, after controlling for age and repeated measures. Partial spearman rank correlations (regressing out the effects of age) were used to examine the relation between postural stability and autism/autism-like symptom severity.
Results:
There was a main effect for surface, $p < .001$, but not for group status, $p = .86$. Contrary to our hypotheses, there was not a significant surface-by-group interaction, $p = .65$. However, there was a significant three-way interaction between group, surface condition and FSIQ, $p<0.05$. This interaction suggests that those in the ASD group with lower FSIQ had the most difficulty with the unstable surface compared to the rigid surface. FSIQ was not associated with postural sway area in the typically developing group under either surface condition.
Conclusions:
ASD diagnosis alone was not predictive of greater balance challenge on the unstable surface. Instead, only youth on the autism spectrum with lower IQs exhibited differentially more balance challenge on the unstable surface. These results suggest that balance challenge may be related to more severe autism and autism-like symptoms. Further, unstable surfaces, which are common in day-to-day life, may present a particular challenge to the balance of individuals on the autism spectrum with more severe symptom profiles.

203 **164.203** Stereotypies in Autism: An Innovative Mathematical Approach to Depict the Natural Association Scheme of Their Co-Occurrence

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Background:
In autism, stereotypies (stereotypic movement disorders) are frequent and disabling and represent one of the most complex clinical pictures due to a broad spectrum of anomalies.Following the new wave of biology-based research in autism, motor anomalies and other repetitive behaviors are increasingly receiving attention. Indeed, the co-occurrence of many different stereotypies in the same subject theoretically offers the possibility to derive associative patterns useful in developing interpretative models.
Objectives:
The aim of this study is to analyze stereotypies patterns observed in a sample of children and adolescents residing at our Institute and subsequently classify them by means of video-recordings. By using advanced machine learning systems, we are able to develop a semantic connectivity map of the variables under investigation.
Methods:
To define the spectrum of expressions of stereotypies we studied 67 autistic individuals which, as a group, expressed 37 different types of stereotypies defined through standardized video-recording. All individuals but one presented a certain number of stereotypies: average = 11.5; range 0-27. The data were analyzed with a special kind of unsupervised artificial neural network (Auto-CM). Auto-CM is able to a semantic connectivity map in which the matrix of connections, visualized through a minimum spanning tree filter, takes into account nonlinear associations among variables and captures connection schemes among clusters. In this way, the patient state can be viewed as an hyperpoint in a “multimorbidity space” in which each dimension corresponds to a quantitative phenotype.
Results:
The semantic connectivity map showed a meaningful scheme of connections among stereotypies.As far as motor abnormalities are concerned, mouth-trunk-arms movements constitute a central axis of the system from which all other type of movements involving head, legs, shoulder and feet take place. Toe walking is directly linked to other walking abnormalities. Licking, biting, smelling, rubbing and touching body parts form a unique cluster associated to medium ID severity and separate from licking, biting and smelling objects, which is associated to mild ID severity. Severe ID is associated to simple voicing and facial grimacing.
Conclusions:
Machine learning algorithms are able to depict the complex pattern of stereotypies commonly observed in autism, thus allowing for a better definition of major phenotypes that are amenable for future large epidemiological surveys.

204 **164.204** The Importance of Teaching Motor Imitation to Children with Autism: Higher Imitators Can Look to the Face Region More Than Lower Imitators When Observing Motor Gestures.

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Background: Imitation can serve two skills, to direct own attention to model stimulus and to do same gestures as model stimulus. However there were few studies to show the association between visual attention and imitation precision (Vivanti, Nadig, Ozonoff, & Rogers, 2008).
Objectives: The purpose of this study is to investigate the relationship between imitation precision and visual attention to face region of motor, object, and oral-facial stimulus.
Methods: 10 children with autism were included in this study. The range of chronological ages was 4 years to 6 years, and developmental age ranged from 1 year to 3 years. We plan to recruit more participants.The experiment was conducted in a testing room at a laboratory. All children participated in the imitation assessment task and eye-tracking assessment task. They received a structured imitation assessment that included 6 object, 6 motor, and 6 vocal imitation tasks. Each child saw symmetric (e.g. touch own head with own hands) and asymmetric gesture (e.g. touch own head with a hand and touch own stomach with the other hand), self (e.g. touch own head with own hands) and other (touch other’s head with own hands) directed gesture on object, and oral (e.g. make noise //a//) and face gestures (e.g. extend tongue). Children also received eye-tracking assessment task.Each child was seated in a chair at a table 30 inches from an 23.5 × 13.3 inch monitor and required to look at experimental stimulus. It was composed of object, motor, oral-facial video clips, which was same as imitation assessment task.
Results: We used Spearman correlations to examine the associations between each imitation precision and fixation durations to face region for each tasks. The result showed that imitation precision was correlated with total time spent looking at face region observing motor stimulus (r=.790, p=.007). The imitation precision wasn’t associated with total time spent looking time at face region observing object and vocal stimulus (object ： r=.419, p=.228; vocal: r=.158, p=.663).
Conclusions: The result demonstrated that higher imitator had more looked at the face region observing motor stimulus. Our findings suggest that teaching motor imitation is one of the most important for early intervention to increase general and selective visual attention to adult. On the other hand, there is no necessity for children with autism who show higher imitation performance to look face when observing object and vocal stimulus, because they have only to look object or hear the vocal stimulus. This study is the first to specifically examine the relationship between imitation precision and visual attention to face region when observing motor, object and vocal stimulus. We plan to collect the data for typically developmental children and compare with these results.

205 **164.205** The Influence of Noise on Autonomic Arousal and Cognitive Performance in Autism Spectrum Disorder

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Background: As many as 95% of individuals with autism spectrum disorder (ASD) experience sensory dysfunction, and the ubiquitous nature of sensory stimuli can present significant challenges to everyday functioning. Although previously unexplored, it is particularly important to understand how sensory stimuli impede an individual's ability to learn and perform cognitive tasks, especially given the overwhelming sensory nature of many education and workplace environments. Additionally, overwhelming sensory input activates the autonomic nervous system's stress response, which may be a key mechanism in the relationship between dysregulated sensory processing and difficulties in cognitive performance.
Objectives: To model the impact of sensory reactivity on cognitive functioning, we investigated the relationship between noise (a pervasive and challenging sensory stimulus) and performance by experimentally manipulating noise levels and task difficulty during measures of working memory. We concurrently collected sympathetic and parasympathetic responses during these tasks to explore the role of autonomic arousal in this relationship.
Methods: Participants included 22 adolescents with ASD (mean age=14.5, range=12-17 yrs) and 18 typically developing (TD) controls (mean age=15.1, range=12-17 yrs). Diagnoses were confirmed using the ADOS and ADI-R in the ASD group and ruled out using the ADOS and SRS in the TD group. Groups were matched on age and Wechsler Verbal Comprehension Index. Participants completed a series of visually presented number span tasks in a 2 x 2 experimental manipulation of noise levels (quiet vs. 75dB gated white noise) and task difficulty (forward span vs. backward span). Electrocardiography, respiratory sinus arrhythmia, and electrodermal activity were collected continuously throughout baseline, cognitive conditions, and recovery periods.
Results: Analyses of cognitive performance data revealed a significant noise (quiet vs. noise) x difficulty level (forward vs. backward) interaction, F=7.25, p=.01, with both groups doing better with the addition of noise in the forward condition, and the ASD group doing marginally worse with the addition of noise in the backward condition. Analyses of heart rate data revealed a significant group x noise x difficulty level interaction, F=7.42, p=.01, with both groups showing increased heart rate with the addition of noise in the forward condition, but only the ASD group showing continued increases in heart rate with the addition of noise in the backward condition, t= -2.10, p<.05. Correlations between the performance and autonomic data revealed an adaptive effect of increased arousal in the forward condition for both groups, r= -.48, p=.004. However, for individuals with ASD, there was a detrimental relationship between increased arousal and performance in the backward condition, r=.60, p=.05.
Conclusions: This study is one of the first to investigate specific adaptive consequences of sensory processing dysfunction in ASD. Findings indicate that simultaneously processing background noise while performing demanding cognitive tasks has both performance and physiological consequences. Importantly, the strongest group differences were in autonomic reactivity, highlighting the importance of monitoring functioning and well-being through multiple methods. These results underscore the importance of minimizing sensory demands in learning contexts for individuals with ASD and suggest that self-regulation interventions may be particularly helpful in minimizing autonomic effects of dysregulated sensory processing.

206 **164.206** The Relation Between Locomotor Dynamics and the Acoustic Startle Response and Its Modulation in Children with Typical Development and Those with Autism Spectrum Disorders

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Background: Translational research of autism spectrum disorders (ASD), using objective and quantitative behavioral phenotypes and neurobiological endophenotypes, may facilitate a deeper understanding of the underlying mechanisms of ASD.
Objectives: The objective of this study was to investigate the relationship between locomotor dynamics and the profile of the acoustic startle response (ASR) and its modulation in children with ASD and typical development (TD).
Methods: ASR and its modulation, including prepulse inhibition (PPI), was investigated in 14 children with ASD and 13 children with TD. The electromyographic activity of the left orbicularis oculi muscle to acoustic stimuli of 65 to 105 dB sound pressure level, in increments of 10 dB, was measured to evaluate ASR. Average eyeblink magnitude for each acoustic stimuli intensity and average peak startle latency of ASR was evaluated. Locomotor activity i.e. spontaneous physical activity in daily life, was also continuously measured by a watch-type actigraph during a long school vacation. We examined sleep measures, including sleep latency, as well as locomotor activity statistics, including the mean and skewness of all day and daytime activity.
Results: Compared to in the TD group, among ASD children the skewness of all day activity was negative and highly statistically significant, while the skewness of daytime activity was also negative but at a borderline level of statistical significance. For all children combined, actigraph measured sleep latency was significantly related to PPI at the prepulse intensity of 70 dB (PPI70). Increased mean and higher negative skewness values for all day activity were significantly related to reduced PPI70, while for daytime activity these values were associated with a greater ASR magnitude to weak stimuli of 65 dB. Conclusions: Hyper-reactivity, examined as ASR magnitude to weak stimuli was related to locomotor activity, characterized by higher mean and higher negative skewness values during daytime, and reduced sensorimotor gating examined as PPI, to these values occurring all day. PPI was also related to sleep latency. The comprehensive investigation of locomotor activity as well as ASR and its modulation, including PPI, might extend understanding of the neurophysiological basis underlying ASD and other psychiatric problems in children.

207 **164.207** The Relationship Between Audiovisual Statistical Learning and Autistic Traits

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Background:
Sensory issues are a pervasive symptom associated with Autism Spectrum Disorder (ASD). One commonly reported issue is a decreased ability to integrate multisensory information, driven by a reduction in multisensory temporal processing (for review, see Stevenson et al, 2015, Autism Research). The predictive coding hypothesis suggests this is due to a decreased ability to learn statistical relationships between multiple sensory inputs.
Objectives:

1. Directly test statistical learning ability of individuals with and without ASD
2. Determine if there is any relationship between ASD traits and statistical learning abilities

Methods:
To date, participants included 63 typically developed (TD) adults and 11 children with and without ASD. Participants completed a well-characterized statistical learning paradigm. In three counter-balanced runs, participants were presented with three-minute adaptation phases that consisted of repeatedly presenting audiovisual stimulus pairs (flash-beeps) with a consistent temporal relationship, either synchronized, audio-leading by 235ms, or visual-leading by 235ms (**Figure A**). Participants were then presented with flash-beep stimulus pairs with varying temporal offsets (auditory-leading by 400ms to visual-leading by 400ms) and performed a simultaneity judgement task; “Did the flash and beep occur at the same time?”Â (**Figure B**).
Participants mean responses at each offset were fit with a Gaussian curve, and the temporal offset at which they were most likely to perceive stimuli as synchronous was extracted (PSS; **Figure C**). This paradigm typically shifts individuals’ PSS towards the offset to which they were adapted. For example, following visual-leading adaptation, a participant’s PSS shifts to more visual-leading offsets.
Participants also completed the Autism Quotient (AQ), a measure identifying the severity of 5 different traits associated with ASD: social skills; attention switching; communication; imagination; and attention to detail. We correlated shifts in PSS, a measure of statistical learning, with each subscale, with the a priori hypothesis that a relationship would be seen with the *attention to detail* subscale.
Results:
Given the current distribution of participants, data reported here are from our adult TD group. Preliminary results suggest this pattern is consistent with ASD and TD children. Mean PSS were calculated for each adaptation condition (**Figure D**): synchronous (mean=4.1ms, s.e.=6.0ms), audio-leading (mean=4.4ms, s.e.=7.4ms), and visual leading (mean=51.5ms, s.e.=8.9ms). Shifts of PSS in auditory-leading and visual-leading adaptations were then compared to their PSS in the synchronous adaptation with paired t-tests (Auditory-leading p=0.95, t=0.05; Visual-leading p=0.00000008, t=6.23). The significant shift in PSS in the visual-leading adaptation condition was correlated with the attention to detail subscale of the AQ (p=0.0009, r=-0.45;**Figure E**). Thus, less adaptation was related to increased severity of the attention to detail ASD trait.
Conclusions: Â
Results indicate that individuals showing greater severity of the ASD trait “attention to detail” were less able to adapt to the statistics of their sensory environment. This supports the predictive coding hypothesis, suggesting individuals with a greater focus on detailed or local aspects of sensory inputs are less able to learn the statistical temporal relationship between audiovisual inputs, which are likely to impact the ability to integrate multisensory stimuli, as the ability to integrate is in large part driven by the temporal relationships between sensory inputs.

208 **164.208** The Relationship Between Sensory Challenges and Executive Function Differs By Patterns of Sensory Responses in Preschoolers with Autism

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Background: Sensory challenges, including sensory hyperresponsivity (i.e. over-reactivity to sensory input) and sensory hyporesponsivity (i.e. under-reactivity to sensory input), occur in over half of children with autism. Despite the role of executive functions, such as the ability to shift attention and inhibit behavioral responses, in the regulation of behavioral reactions to sensory stimuli, a previous study of high-functioning children with autism did not find a link between overall sensory challenges and executive dysfunction. One potential explanation for this lack of a link is that different patterns of sensory challenges are correlated with distinct executive dysfunctions.
Objectives: To identify the extent to which specific domains of executive functions, namely the abilities to shift attention and to inhibit responses, are correlated with distinct patterns of sensory challenges.
Methods: 29 children (22 Males, 7 Females) with autism between 3 and 6 years old were recruited for a study on sensory over-responsivity and anxiety in autism. Autism diagnoses were confirmed with the Autism Diagnostic Observation Schedule (ADOS-2) and the Autism Diagnostic Interview (ADI-R). Sensory challenges were characterized through parent report with the Sensory Experiences Questionnaire 3.0 (SEQ) and through behavioral observation of the child with the Sensory Processing Assessment (SPA) and the Tactile Defensiveness and Discrimination Test-Revised (TDDT-R). Executive functioning was measured through parent report using the Behavior Rating Inventory of Executive Function – Preschool Version (BRIEF-P). We focused on the three main scales of the BRIEF-P: Shifting, Inhibition, and Emotional Control. The Shifting scale assesses a child’s ability to flexibly switch behaviors in response to external demands, including making transitions, problem-solving, and switching attention. The Inhibition scale assesses a child’s ability to resist impulses and to inhibit their behavior appropriately. Finally, the Emotional Control scale measures the impact of executive dysfunction on a child’s ability to modulate their emotional responses.
Results: Both parent reported and observational measures of sensory hyperresponsivity were associated with worse scores on the Shifting scale of the BRIEF-P. Parent reported sensory hyporesponsivity was also associated with greater dysfunction in the Shifting scale, however this relationship did not remain significant when controlling for age and IQ. Parent reported sensory hyporesponsivity was correlated with higher scores on the Inhibition scale of the BRIEF-P.Â Finally, emotional control was associated with parent reported hyper- and hyporesponsivity. ADOS severity was not associated with degree of sensory challenges or executive dysfunction.
Conclusions: Results suggest that different patterns of sensory challenges are correlated with distinct executive dysfunctions in young children with ASD. Specifically, after controlling for age and IQ, difficulties with flexibly switching behaviors are associated with increased sensory hyperresponsivity, but not sensory hyporesponsivity. On the other hand, difficulties with behavioral inhibition is associated with increased sensory hyporesponsivity, but not sensory hyperresponsivity. Understanding how specific neurocognitive mechanisms may influence children’s ability to regulate sensory challenges may provide more specific targets for early intervention aimed at decreasing the negative impact of sensory challenges, such as decreased adaptive behavior and increased parental stress, in individuals with ASD.

209 **164.209** The Use of Multi-Sensory Environments (MSE) for Children with Autism Spectrum Disorder (ASD): A Qualitative Investigation

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Background: Multi-Sensory Environments (MSEs; also known as sensory or Snoezelen rooms) are widely used with children with autism spectrum disorder (ASD), particularly in educational settings. MSEs are purpose built rooms equipped with a variety of sensory materials that can be controlled for therapeutic benefit. However, despite the popularity of MSEs, there is limited research and understanding of how these rooms function, their benefits, and their overall efficacy. In addition, most research has looked at users with a range of special educational needs and not focussed on the specific experiences of those with ASD.
Objectives: Using qualitative interviewing, we aimed to establish the practitioner perspective on the use of MSEs for children with ASD. We were particularly interested in: (i) how MSEs were used and (ii) the perceived benefits of MSEs.
Methods: Twelve practitioners (11 female, aged 24-62 years) across 6 special needs schools in the UK participated. The practitioners were either teachers or teaching assistants and had been working with children with ASD in MSE for between 3 and 20 years. Each participant was interviewed using a semi-structured interview, with the data analysed using qualitative thematic analysis (Braun & Clarke, 2006).
Results: Five themes emerged from the interviews: (1) “Child is central”, the belief that the child’s needs, capabilities and preferences defined how and when the MSE should be used, as well as the potential benefits; (2) “Practitioner engagement”, the belief that an active practitioner was necessary for the child to benefit, and that because of this more research and practitioner training was needed; (3) “Positive properties of MSE”, the belief that MSEs had distinct properties, such as flexibility of use and motivational capacity, that contributed to their efficacy. (4) “Benefits for the child”, the MSEs were believed to benefit behaviour, cognition and mood, as well as learning; (5) “Challenges for MSE use”, MSEs were believed to have some drawbacks, including the potential to elicit negative behaviours.
Conclusions: The way in which MSEs were used depended on the needs of the child, and optimal use required an active and trained practitioner. Perceived benefits from MSE use included improvements in behaviour, cognitive ability and mood, with opportunities for teaching and learning within the MSE also possible. Perceived benefits could sometimes have ‘carry over’ effect to outside of the MSE. These findings are currently being used to inform an empirical study on MSEs and ASD within a purpose-built MSE at the Wales Autism Research Centre (WARC), Cardiff University.

210 **164.210** Treatment for Auditory Hyper-Reactivity Behavior in Children with Autism Using Exposure and Response Prevention Principles

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Background: Auditory hyper-reactivity is estimated to affect up to 66% of children with autism spectrum disorders (ASD) and has been linked to both child and family mental health factors such as higher levels of stress and anxiety. Although hyper-reactivity to auditory stimuli is a significant problem for these children and their families, there are currently no evidence based treatments available to treat this problem in ASD. Exposure and response prevention (E/RP) is highly effective form of treatment for reducing escape/avoidance behaviors associated with obsessive and compulsive disorders, anxiety and phobias. It has also been shown to be effective for reducing OCD behaviors in children with concurrent ASD suggesting that children with ASD may also respond well to this type of treatment approach being applied to sensory hyper-reactivity behaviors.
Objectives: Case series reporting the feasibility of implementing a modified E/RP approach for reducing auditory sensory over-responsive behaviors in children with ASD.
Methods: A modified E/RP protocol was provided in an outpatient therapy clinic to patients with high functioning ASD who report a strong aversion to specific sounds. Parent and patient report information was collected pre- and post- treatment regarding the level of difficulty tolerating certain sounds as well as a description of types of behavioral responses and level of anxiety experienced when exposed to these sounds. Behavioral responses and self-reported levels of anxiety were collected each treatment session before, during and after exposures. Exposure hierarchies were designed to address specific auditory aversions for each patient. Prior to beginning exposures, patients and parents were educated on how to identify and report levels of anxiety and arousal level through self-regulation treatment strategies such as Zones of Regulation or the ALERT Program.
Results: Preliminary results suggest that patients with high functioning ASD respond well to a modified E/RP protocol as evidenced by decreased avoidance/escape behaviors and decreased self-reported levels of discomfort/anxiety to auditory stimuli that were initially reported to be intolerable.
Conclusions: A modified E/RP approach is feasible to implement for the purpose of reducing avoidance behaviors and anxiety associated with auditory hyper-reactivity in patients with high functioning ASD. This study supports the idea that auditory hyper-reactivity, in some patients, may be the result of a conditioned response and thus, an E/RP based approach may be effective for these patients. Further studies are warranted to further evaluate the efficacy of this approach, generalization and maintenance of treatment outcomes, patient-treatment matching as well as parent education/training on home programs. The results from these studies can potentially: (a) improve children’s abilities to tolerate every day sounds and to engage in activities of daily living and (b) improve evidence-based practice for treating sensory processing difficulties in ASD. This work represents the first step in evaluating the feasibility and efficacy of applying E/RP treatment to reduce auditory hyper-reactivity in children with ASD.

211 **164.211** Unusual Auditory Filtering Behaviors in Minimally Verbal ASD: A Mechanism for Regulating Auditory Input?

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Background: Many people with ASD exhibit behaviors that suggest irregular responses to auditory inputs and a need to actively regulate their auditory environment. Verbally fluent ASD children with high frequency atypical auditory behaviors and overall repetitive and restricted behaviors (including atypical responses to sounds) demonstrate abnormal sensitivity to sound changes in psychoacoustic experiments and have been described as having average nonverbal IQ and delayed language acquisition (Jones et al., 2009; Kargas et. al., 2015). No research has explored whether minimally verbal ASD individuals with frequent auditory behaviors display atypical sensitivity to sound changes, a necessary mechanism for accurately filtering out irrelevant sounds in the environment. In addition, no research has determined whether regulatory behaviors or filtering issues interfere with receptive language.
Objectives: Our objective was to examine the relationship between atypical auditory behaviors and atypical auditory processing, especially in minimally verbal individuals, and the relationship of these factors to receptive language skills.
Methods: Auditory behaviors were coded from ADOS recordings in individuals with ASD aged 5-21. Individuals were classified as either minimally verbal (ASD-MV: single word or phrase speech) or verbally fluent (ASD-V: complex speech). We coded: 1) Prolonging and/or abnormally manipulating sound-making objects, 2) Humming and/or altering ear shape, 3) Covering the ears with hands or fingers or appearing distressed by noise. Nonverbal intelligence and receptive language were measured with the Leiter and PPVT, respectively. Event-related potentials (ERPs) were measured in a passive, single-stream oddball mismatch negativity paradigm designed to quantify automatic detection of sound input change.
Results: ASD-MV individuals displayed a greater incidence of auditory behaviors than ASD-V individuals ($\chi^2(1)=19.66$, $p<0.01$), with the greatest difference in humming and ear shaping ($t(10)=-2.24$, $p=0.04$). Significant differences between groups were not observed for the other two behavioral categories (object manipulation ($t(10)=-1.83$, $p=0.09$); avoidance/ear covering ($t(10)=-1.43$, $p=0.18$)). Because we observed a large range in the frequency of auditory behaviors in the ASD-MV group, we did further within-group analyses. We found that time spent engaging in auditory behaviors significantly correlated with receptive language raw scores (Rho=-0.575, $p=0.003$; Figure 1A), but not with nonverbal intelligence (Rho=-0.256, $p=0.23$). Increases in time spent engaging in these behaviors was also associated with reduced early ERP responses to sound change (Rho=0.54, $p=0.08$; Figure 1B).
Conclusions: This work finds that auditory behaviors like humming and ear shaping are more common in ASD-MV than ASD-V. Within ASD-MV, there is a subset of individuals engaging in auditory behaviors at least 10% of the time. Individuals in this subgroup exhibit extremely low receptive language skills, but within-range nonverbal intellectual functioning, relative to others who are also minimally verbal. There is evidence that this subgroup is less efficient at detecting sound input change and consequently may be less efficient at separating and filtering sounds. Past experience with under-filtered sounds may increase auditory behaviors to serve as a mechanism for regulating auditory input; however, this regulatory activity may also inadvertently block sounds that are important. Future work should continue to investigate the clinical implications of how these behaviors affect receptive language processing.

212 **164.212** Videogames for Children and Adolescents with Autism Spectrum Disorders: Users Perspectives

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Background:
Typical children and adolescent spend their free time with videogames. Individuals with autism are no exceptions and videogames might be very good tools for socialization and interactions though many prejudices still exist and limits the use and potential of them for interventions.
Objectives:
The aim is to report results of an ongoing descriptive study of the preferences and use of videogames of an argentinian sample of children and adolescents with ASD for improving social interventions with videogames.
Methods:
We design and adapt a questionnaire of videogames based on previous experiences for children and adolescents that assess key areas such as preferred device they play with more often, preferred consoles, who they play with more often, and with whom they enjoy to play with more, amount of hours playing a day, preferred games, and preference for violent videogames. All participants (N= 30, 25 male, 5 females) where assessed individually to complete the questionnaire and was adapted in some cases to make sure they understand the questions. They all have a previous reliable diagnosis of ASD and were assisting to social skills groups in the same setting during the research period 2015-2016. All individuals had verbal with IQ from mild ID to normal IQ with ages from 9 to 18. Statistical descriptive data was analyzed.
Results:
All children were able to complete and understand the questionnaire. The distribution of devices used for play was even with consoles (36%) tablets (29%) computers (29%) and a small part with smartphones (6%). At home individuals played with Wii® (47%) and Play Station® (44%) and very few XBOX®(9%).Individual reported playing more often alone (57%) and less frequently with peers (21%)friends (11%)and online (11%) they also reported than then enjoyed more playing alone (66%) rather than with friends (17%) or siblings(7%) or online(10%). Half of the sample reported not liking videogames with blood, guns, and violence (50%) and some report to like them sometimes (29%) and smaller part reported to enjoyed them always (21%). Almost half of the sample did not know how much time they spend playing during school days (41%) or weekends (46%) and some others reported playing one hour (31%) or two (32/23%) a day. Data of favorite games was collected but was related to special interests and was very heterogeneous and more than 200 games in were identified without finding statistical significance in them.
Conclusions:
Though limitations on sample size, preliminary results might suggest that children with ASD enjoyed playing with videogames in different devices. Structuring and measuring time of play of videogames is evident and necessary. The fact they like and play more often alone is an interesting focus on intervention considering most of them have one console at home. Violent videogames, a general concern of parents and professionals, might not be the most popular ones for people with ASD unlike the typical peers and their preferences might be tied to their special interest, and might be useful to foster social motivation and interactions if videogames are played with others.

213 **164.213** Visual Integration of Direction and Orientation Information in Autistic Children

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Background: Theoretical accounts propose that autistic visual perception is characterised by a focus on details, and a disinclination or reduced ability to integrate information across parts of the scene in order to perceive the overall whole. In contrast to these theories, we recently demonstrated *enhanced* integration of visual motion signals in autistic children compared to typically developing children (Manning et al., 2015, *J Neurosci, 35*(18), 6979-6986).
Objectives: Here, we had two main aims: 1) to investigate the robustness of our finding of increased motion integration within a new sample of autistic and typically developing children, and 2) to determine whether increased integration in autistic children would extend to a static, orientation task.
Methods: We presented motion and orientation equivalent noise and coherence tasks to 46 autistic children aged 6 to 14 years and 45 typically developing children matched in age and non-verbal IQ. The equivalent noise tasks consisted of two interleaved conditions: a high-noise condition in which children judged the average direction or orientation of elements while the external noise (standard deviation of direction or orientations) was manipulated, and a no-noise condition in which children were required to judge the direction or orientation of elements sharing the same direction or orientation. The thresholds from this task were subjected to equivalent noise modelling to yield measures of local internal noise and global sampling. In the coherence tasks, the proportion of signal elements sharing the same direction or orientation amidst otherwise random noise elements was manipulated. We assessed group differences using a combination of frequentist and Bayesian statistical approaches.
Results: When combining data from the motion tasks of the original and replication experiments, autistic children had increased integration of direction information compared to typically developing children in the high-noise condition (indexed by higher maximum tolerable noise values), yet similar no-noise and coherence thresholds as typically developing children. Equivalent noise modelling revealed increased sampling in autistic children for motion information but no conclusive evidence for atypical levels of internal noise. Yet, analysis of the data in the replication sample alone did not provide sufficient evidence either in favour or against the hypothesis of increased integration in autism. There was no evidence of differences between autistic and typically developing children in the orientation equivalent noise and coherence tasks.
Conclusions: Overall, autistic children integrated motion information better than typically developing children. However, the groups overlapped considerably and there was substantial individual variability. Therefore, the effect may not always be detected in small samples due to sampling error. There was no indication of atypical integration of orientation information in the current study, although larger samples will be required in order to provide conclusive evidence. These results help characterise the nature of sensory processing in autism, which is of high import and relevance given the recent inclusion of sensory symptoms in diagnostic criteria. If increased integration is specific to motion information, domain-specific accounts of autistic perception will be required.

214 **164.214** Visual Spatial Channel Bandwidth Varies with Autistic Trait Level

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Background:
Visual processing in autism is the topic of ongoing debate (Simmons et al, 2009). One of the most basic measures of visual performance is contrast sensitivity - the detectability of small changes in light intensity. Previous studies have reported lower, higher and equal sensitivities in autistics, relative to controls, depending on the stimulus used (Adams et al, 2010; Koh et al, 2010). Stimulus complexity potentially also affects contrast sensitivity differentially (Bertone et al, 2005), and autistics have greater difficulties when perceiving “masked” stimuli (Greenaway, Davis & Plaisted-Grant, 2013). These difficulties are potentially linked to neural noise theories of autism (Simmons et al. 2009; Dinstein et al, 2015), given physiological research that relates increased noise to increased channel bandwidths (i.e. information taken in) in neural processors, which is in turn a suggested explanation for sensory filtering difficulties in autism (Plaisted et al. 2003). Furthermore, sensory difficulties vary with autistic trait level, as measured by the Autism Spectrum Quotient (AQ; Baron-Cohen et al. 2001; Robertson & Simmons, 2013).
Objectives:
To investigate the potential link between autistic trait level and the bandwidth of visual spatial channels.
Methods:
38 participants completed the study, which involved two visual tasks and completing the AQ. Both tasks were presented in a standard two-interval forced choice paradigm. Task 1 was a contrast detection task, which measured the thresholds (i.e. minimum contrast) for detecting a sinusoidal variation in luminance (Gabor patch) centred at three spatial frequencies (SFs): 0.5, 1, and 2 cycles per degree(cpd). In task 2, participants were asked to detect a 1-cpd target stimulus in the presence of three different masks (0.5-, 1-, and 2-cpd) – whilst the mask contrast was held constant (10x detection), the target stimulus contrast was adjusted to measure thresholds. The size of the mask varied with SF to counteract stimulus spatial bandwidth differences. A ratio of the thresholds (masked vs. unmasked) for the target stimulus was calculated to estimate the SF processing bandwidth at 1-cpd.
Results:
Groups of individuals with high (N = 18; mean AQ = 24) and low (N = 20; mean AQ = 9) levels of autistic traits were formed by a median split. Bootstrapped t-tests (iterations = 1,000) revealed group differences in both tasks. For unmasked stimuli, participants with higher levels of autistic traits had significantly higher contrast sensitivities (lower thresholds) at 0.5-cpd (t=-47.65,p<.001) and 1-cpd (t=-8.28,p<.001) and lower sensitivity (higher thresholds) at 2-cpd (t=53.87p<.001). Additionally, the threshold ratio (estimation of SF bandwidth at 1-cpd) was significantly higher for those with higher levels of autistic traits at all SFs (t=-34.62;-11.43;-58.66,p<.001).
Conclusions:
These data suggest that (1) contrast sensitivity varies with autistic trait level, and (2) those with higher levels of autistic traits have broader spatial frequency channels, in line with theoretical predictions (Plaisted et al. 2003; Simmons et al. 2009), thereby lending support to neural noise theories of altered perception in autism, and meriting further testing in the autistic population.

Poster Session
165 - Social Cognition and Social Behavior II
5:00 PM - 6:30 PM - Golden Gate Ballroom

215 **165.215** A Meta-Analysis on Local and Global Face Perception in Individuals with ASD

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Background: Atypical global and local visual processing is often reported in individuals with ASD. However, findings on global and local face processing are inconsistent: Some studies have, for instance, revealed reduced face inversion effects in ASD, whereas others did not, leaving the field inconclusive. Factors such as stimulus, paradigm and participant characteristics could contribute to the large inconsistencies both within and across tasks.
Objectives: Instead of yet another empirical study evaluating a specific aspect of holistic face processing in individuals with ASD, the field is in need of a systematical and quantitative overview of the available evidence. We therefore wanted to systematically examine and combine all empirical data on this topic by means of a meta-analysis, in which the effect size across different studies was calculated, evaluating the overall evidence for differences in local and global face processing in individuals with and without ASD.
Methods: We have performed a formal meta-analysis, which incorporated the empirical data of 27 articles and several moderator variables in our analysis.
Results: Overall, results provided evidence for a general deficit in face processing in individuals with ASD ((Hedges' *g* effect size = -0.70). The ASD group performed significantly worse on both global (*g* = -.67) and local face processing tasks (*g*= -.76). However, no moderating effects of task or stimulus characteristics were found.
Conclusions: This meta-analysis showed an overall face perception problem in individuals with ASD. However, current analyses did not provide evidence for atypical local or global face processing. In addition, the impact of several moderating variables is discussed.

216 **165.216** A Pilot Investigation of the Relationship Between Parasympathetic Arousal, Stress, and Social Functioning in Youth with ASD before and after a Peer-Mediated, Theatre-Based Intervention

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Background: Many individuals with autism spectrum disorder (ASD) experience significant physiological arousal and stress during social interaction. Dysregulation of the autonomic nervous system (ANS) has also been reported in ASD. Respiratory sinus arrhythmia (RSA) is an indicator of parasympathetic regulation and theorized as a marker of behavioral flexibility. Parasympathetic dysregulation in ASD may be associated with impaired social functioning, but a peer-mediated theatre intervention might help alleviate this altered ANS arousal during play.
Objectives: To investigate associations between RSA, stress, and social functioning before and after a theatre intervention. RSA was hypothesized to correlate with stress, social symptoms, and amount of cooperative play. Further, differences in RSA were expected following the 10-week intervention.
Methods: The pilot investigation consisted of two preliminary studies. Study 1 included 21 children with ASD, ages 8 to 16. Children participated in the Peer Interaction Paradigm (PIP), a 20-minute playground interaction consisting of four 5-min. periods of independent (T1, T3) and cooperative play (T2, T4). RSA was collected at baseline and throughout the interaction. Parents reported stress, social functioning, and internalizing symptoms via the Stress Survey Schedule (SSS), Social Responsiveness Scale (SRS), and Child Behavior Checklist (CBCL). Pilot Study 2 assessed changes in RSA following a 10-week theatre intervention, with participants randomly assigned to the experimental group (n=12) or wait list control (n=9). Statistical analyses included ANCOVA for group differences and Pearson correlations for associations. Baseline RSA was subtracted from RSA during play to create difference scores representing RSA suppression, with more negative scores indicative of greater suppression.
Results: In Study 1, RSA during cooperative play T4 was negatively associated with total stress at trend (r=-.42, p=0.06) and significantly negatively correlated with the Changes domain of the SSS (r=-.51, p=0.02). Regarding ANS arousal and play, self-play during T2 was negatively associated at trend-level with RSA suppression (r=-.42, p=0.06), such that more self-play was correlated with a larger decrease in RSA. Amount of self-play at T2 positively correlated with social problems (r=.47, p=0.04) and internalizing symptoms (r=.51, p=0.02) on the CBCL and SRS total T-score (r=.44, p=0.05). In Study 2, no treatment effects were observed for baseline RSA or during the PIP (all p>0.05). RSA suppression was not associated with cooperative play (all p>0.05) either before or after the intervention.
Conclusions: Decrease in RSA during a stressor is considered a mobilization response. For youth with ASD, more stress, especially from changes throughout the day, was associated with greater decreases in RSA. This suggests children with higher stress perceive social interaction as more threat-inducing, indicated by greater suppression of the parasympathetic system. Those with lower RSA during play also engaged in more self-play, providing evidence that greater RSA suppression is associated with less social engagement. Increased self-play was related to social symptom severity, suggesting potentially important relationships between autonomic and social functioning that warrant further investigation. Though no treatment effects were observed, conclusions are limited due to the very small sample size and require future studies of a larger cohort to assess for significant changes following intervention.

217 **165.217** A Systematic Review of the Eye Tracking and Electroencephalography Correlates of Facial Emotion Recognition in Individuals on the Autism Spectrum

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Background: While difficulties in facial emotion recognition (FER) are quite consistently reported in Autism Spectrum Disorders (ASD), behavioural studies alone cannot elucidate the specific nature of this impairment. Eye tracking (ET) and electroencephalography (EEG) provide insight in to the underlying attentional and neurological correlates underlying performance, allowing for a greater understanding of the processing of FER in ASD. Given that these processes change and develop along the developmental trajectory, there is a need to synthesise these findings in relation to developmental stages in order to investigate how the maturation of these systems impact FER in ASD.
Objectives: This systematic review evaluates the research examining the ET and EEG outcomes of individuals with ASD during FER in order to provide an overview of the current state-of-the-art in the area.
Methods: A systematic review was conducted in accordance with PRISMA guidelines. Six electronic databases were searched for articles examining either ET or EEG in individuals with ASD while completing FER tasks. This review examines 54 articles examining ET or EEG in individuals with ASD during FER meeting inclusion criteria.
Results: Both atypical gaze and cortical activation were found in articles included in this review. Reduced gaze to the eyes of emotionally expressive faces were consistently found in adult studies, however, were less consistently found in child studies, indicating an effect of developmental processes on these functions. Atypical cortical activation was evident across the developmental trajectory with effects being particularly evident for the N170 event related potential. Studies examining quantified EEG suggest that across the frequency spectra, individuals with ASD have atypical cognitive processing of FER, possibly indicating impairment in the pathways involved in the automatic processing of FER.
Conclusions: ET and EEG findings indicate divergent development of the neurocognitive mechanisms of FER in individuals with ASD, which may further be modulated by certain self-regulatory or compensatory strategies. Implications for understanding the social brain in ASD, as well as future directions for the integration of ET and EEG methods are discussed.

218 **165.218** ADOS and IQ As Predictors of Success on a Social Skills Intervention

A. D. Haendel[1], *A. McVey*[1], *B. Dolan*[1], *H. K. Schiltz*[1], *K. A. Willar*[2], *F. Mata-Greve*[1], *A. M. Carson*[3], *E. Vogt*[1], *S. Stevens*[4] *and A. V. Van Hecke*[1], *(1)Marquette University, Milwaukee, WI, (2)Children's Hospital Colorado, Aurora, CO, (3)Baylor College of Medicine/Texas Children's Hospital, Houston, TX, (4)University of Minnesota Medical School, Blaine, MN*

Background: Research has found that higher IQ scores are associated with lower frequency and severity of challenging behaviors in people with Autism Spectrum Disorder (ASD) (McTiernan, Leader, Healy, & Mannion, 2011). There is a paucity of research in the area of looking at IQ and ASD severity in relation to success on social skills intervention programs.
Objectives: The primary objective of the current study was to examine the relationship between Autism Diagnostic Observation Schedule- Generic (ADOS-G: Lord et al., 2000) Total scores and Full Scale IQ (FSIQ) scores on the Kaufman Brief Intelligence Test (K-BIT: Kaufman & Kaufman, 2004), and how they predict response to a social skills intervention.
Methods: Following consent, 42 adolescents between the ages of 11-16 years, with FS IQ greater than 70 (confirmed by the KBIT) and ASD (confirmed by the ADOS-G), participated in the 14-week PEERS®intervention program (Laugeson & Frankel, 2010). PEERS® is a manualized, social skills/friendship training intervention for youth with social challenges that has a strong evidence-base for use with adolescents with autism spectrum disorder (Laugeson et al., 2012). Upon completion of PEERS, adolescents completed self-report surveys: the Quality of Socialization Questionnaire (QSQ: Laugeson & Frankel, 2010), the Friendship Quality Scale (FQS), and the Test of Adolescent Social Skills Knowledge (TASSK: Laugeson & Frankel, 2010). A composite outcome score was then generated from those three measures.
Results: There were significant correlations between FSIQ and ADOS (r (40) = .40, p < .01), FS IQ and outcome (r (40) = -.42, p < .01), and ADOS and outcome (r (40) = -.52, p < .01). A multivariateÂ linear regression indicated that the full model significantly predicted outcome,Â F (2, 39) =Â 9.46,Â pÂ < .01,Â explainingÂ 33% of the variance. However, with both ADOS and FSIQ in the model, onlyÂ ADOS scoresÂ (β=Â -0.422,Â pÂ < .01)Â were a significantÂ predictor of averageÂ outcome, whereas FSIQ was not.Â
Conclusions: Â Our results demonstrateÂ a relationship between ADOS scores and FSIQ scores in adolescents with ASD. However, when considered together, only ADOS scores were a significant predictor of outcome in a social skills intervention. Adolescents with higher ADOS scores, indicating more symptoms of ASD, were more likely to have lower PEERS outcome scores.Â These findings will be examined further by comparing additional participants as well as looking at these outcome measures at pre- and post-PEERS treatment to see if any changes were made due to the intervention. This study has the potential to add literature linking success on social skills intervention programs to FSIQ and ASD severity scores.

219 **165.219** Abnormal Use of Facial Expressions in ASD: A Meta-Analysis

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Background: The abnormal use of facial expressions is a noticeable clinical feature of ASD (APA, 2013), yet this specific aspect of nonverbal communication has received little empirical attention. The existing research on this topic has yielded an inconsistent pattern of results. Some studies show that individuals with ASD are less expressive (Loveland et al., 1994; Snow et al., 1987), are less likely to naturally attend to and imitate others' expressions (McIntosh et al., 2006), and may display confusing, ambiguous or inappropriate facial expressions in which it is difficult to interpret what emotion they are expressing (Brewer et al., 2016; Reddy et al., 2002). However, other studies fail to find group differences in imitative expression (Press et al., 2010) and even show heightened expression in ASD in some circumstances (Capps et al., 1993). Clearly, research is needed to untangle this puzzling pattern of results.
Objectives: The goal of this study is to review and make sense of the existing literature on abnormal facial expressions in ASD. Of special interest is to identify the moderating variables that may be accounting for inconsistent findings in this literature.
Methods: We use meta-analytic techniques to summarize existing effect sizes that compare facial expressions in ASD with matched control participants. We will also examine the influence of several potential moderating variables including study setting (experimental vs. natural), social context of facial expressions (e.g., social vs. nonsocial), task demands (e.g., spontaneous vs. voluntary expression production), and outcome measure (salience vs. quality of expression). More than 30 articles have been retrieved for potential inclusion, although literature searches and data analysis are still in progress.
Results: Thus far, 9 studies have been coded and analyzed yielding 15 separate effect sizes. Across all effect sizes, participants' facial expressions differed significantly from matched comparison groups, cohen's d = .230, 95% CI[0.04, 0.42], p = .018. A few interesting patterns are emerging. First, effect sizes appear to be influenced by the specific dependent measure of interest across studies. For example, large group differences were found in *quality* of expression, cohen's d = .931, p < .001, k = 5, but not for *salience* of expression, Cohen's d = -.104, p = .210, k = 9. Second, the context in which expressions were used influenced the strength of the effect sizes. For example, in naturalistic settings, *social smiles* (expressions directed towards another person) were much less frequent in the ASD participants, Cohen's d = 1.14, p < .001, k = 3, compared to *non-social* expressions which were only marginally different, Cohen's d = .318, p = .077, k = 5.
Conclusions: Initial results suggest that, compared to neurotypicals, people with ASD may not be particularly *less* expressive, but are significantly more likely to convey confusing facial expressions that are difficult for others to interpret. Additionally, in naturalistic settings, children with ASD may not be less expressive overall, but are less likely to use facial expressions with communicative intent or to reciprocate others' expressions. These findings may have important clinical and research implications.

220 **165.220** Adolescent Social Competence in Autism Spectrum Disorder: Associations with Perceptions and Metaperceptions of Peers

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Background: During social interactions with peers, individuals form perceptions of their peers and impressions of what peers think about them -- metaperceptions (Laing et al., 1966). These abilities are important for social success during adolescence when self-identity formation, social transitions, sensitivity to peer evaluations, and perspective-taking skills increase rapidly. Research on perception and metaperception in those with ASD is limited, and may offer insight into mechanisms underlying heterogeneity in social competence observed in adolescents with ASD.
Objectives: We examined associations between perceptions/metaperceptions and observed social behavior during a dyadic interaction using the Perceptions and Metaperceptions Questionnaire (PAMQ).
Methods: Fifty adolescents interacted in pairs consisting of one adolescent with ASD (M_{age}=14.66, SD=1.43; $M_{VerbalIQ}$=105.00, SD=14.79) and a gender-, age-, and verbal IQ-matched unfamiliar adolescent without ASD (M_{age}=14.21, SD=1.34; $M_{VerbalIQ}$=108.48, SD=13.83). Dyads were instructed to get to know each other for five minutes. During the interaction, participants were coded for Social Reciprocity (seeking, eye contact, conversational efficacy, and social ease) and Social Initiative (proportion of time talking, reversed latency to first utterance, reversed latency to first spontaneous utterance, and sharing). Immediately following the interaction, each participant completed the Perceptions and Metaperceptions Questionnaire (PAMQ) indexing perceptions of the peer (e.g., "How cool is ___?") and predictions of peer's impressions (e.g., "How cool does ___ think you are?"). Positively-valenced words indicating liking (e.g., happy) and negatively-valenced words indicating disliking (e.g., boring) were analyzed separately.
Separate Actor-Partner Interdependence Models (APIMs) were used to estimate effects of a peer's perceptions on an adolescent's social behavior, as well as the effect of the adolescent's metaperception on his/her own social behavior.
Results: Path coefficients for all four models are listed in Table 1. Regardless of diagnostic group, adolescents who predicted higher liking ratings from peers displayed more Social Reciprocity, b=.03, t(33)=3.13, p=.004. Adolescents whose peers reported liking them more tended to display more Social Reciprocity, b=.02, t(32)=1.77, p=.09. The more adolescents predicted their peer to dislike them, the less Social Reciprocity adolescents displayed, b=-.03, t(34)=-2.40, p=.02.
Across both groups, adolescents who predicted higher liking ratings from peers displayed significantly more Social Initiative, b=.03, t(37)=3.09, p<.01. Adolescents whose partners disliked them more displayed significantly less Social Initiative, b=-.05, t(36)=-.02, p<.01.
Conclusions: Findings suggest that the way that adolescents believes they are perceived as well as the way that they are actually perceived are important factors relating to social competence. Adolescents with positive beliefs about how they are perceived by peers may subsequently have more reciprocal social interactions. Conversely, adolescents who have reciprocal social interactions with peers may develop positive ideas of how they are perceived by peers. Directionality of effects involving perceptions, metaperceptions, and social competence should be further investigated in future longitudinal studies.

221 **165.221** Affective Sharing and Friendship Reciprocity Among School-Aged Boys with ASD

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Background: Affective sharing plays a defining role in the friendships of typically developing (TD) school-aged boys (e.g., Newcomb & Bagwell, 1995), distinguishing both friends from non-friends and reciprocal from unilateral friendships. Although some research suggests that children with ASD engage in lower levels of affective sharing while interacting with friends (Bauminger-Zviely & Agam Ben-Artzi, 2014), whether it plays a comparably definitive role in the friendship of school-aged boys with ASD remains unseen.
Objectives: This study examined the role of affective sharing in the friendships of boys with ASD aged 8-12, as compared to TD boys.
Methods: 13 boys with ASD and 17 TD boys participated in a 12-minute behavioral observation with a self-nominated friend. Members of each friend dyad were asked to list their top 5 best friends while out of earshot of the other member of the dyad. The behavioral observation was then coded using the Social Interaction Observation System (SIOS; Bauminger, 2002).
Results: Six boys' nominated friends did not spontaneously reciprocate their friendship nomination. Two were from TD-TD dyads (Dyad Group 1), two were ASD-TD (Dyad Group 2) dyads, and two were from ASD-ASD dyads (Dyad Group 3). Dyad Group 3 also had a significantly higher rate of unreciprocated friendships based on the more direct friend nomination procedure than did Dyad Group 1 ($t(18)$=2.39, p=.03). Friendships of boys with ASD demonstrated lower mean levels of time spent in synchronous behavior, responsiveness, and positive social engagement than did those of TD boys at a rate that fell below significance (time spent in synchronous behavior=(t(28)=1.39, p=.14; responsiveness=(t(28)=.27, p=.79; positive social engagement (t(28)=1.77, p=.088; see Table 1). Behavioral observations of unilateral friendships were comparable to those of reciprocated friendships in terms of time spent in synchronous behavior (t(28)=.-1.06, p=.30) and responsiveness (t(28)=-.10, p=.33). However, unilateral friendships demonstrated lower levels of positive social engagement (t(28)=-2.05, p=.05) than reciprocated friendships, regardless of dyad diagnostic status. Specifically, friends who did not spontaneously reciprocate the friendship nomination demonstrated significantly lower levels of positive social engagement during the observed interaction (t(28)=-2.27, p=.03), whereas target children did not (t(28)=-1.66, p=.11), regardless of the diagnostic status of the target child.
Conclusions: Boys with ASD demonstrated lower mean levels of affective sharing in a pattern comparable to what has been previously found in the literature (Bauminger et al., 2008b; Bauminger-Zviely & Agam Ben-Artzi, 2014; See Figure 1). However, differences in affective sharing behavior fell below significance, suggesting that boys with ASD *were* able to engage to a sufficient degree to maintain reciprocal friendships. Additionally, among the four boys with ASD in unilateral friendships, lower rates of positive social engagement than in reciprocated friendships were found among their *friends*, suggesting that the lower rates of affective sharing in unilateral friendships were driven at least as much by the friend's lack of engagement in the friendship as by lower levels of affective sharing on the part of the boy with ASD. Findings suggest that affective sharing plays a comparably central role in the friendships of boys with ASD.

222 **165.222** Are Communication and Social Skills Associated with Emotional Expressions during a Stimulating Play Situation in Young Autistic Children?

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Background: Â Recent work suggests that we are better at interpreting facial emotions of typically developing (TD) individuals than those of individuals on the Autism Spectrum (AS) (Brewer et al., 2015). Also, preliminary findings using the Montreal Stimulating Play Situation (MSPS), showed that AS children, who have similar number of both positive and negative emotions compared to TD children, express emotions coded as "unknown" by typical raters (Jacques et al., 2015). Therefore, it is possible that the failure of TD individuals to infer the accurate mental state in AS individuals have a direct impact on the assessment of socialization and communication domains.
Objectives: To document whether the frequency of emotional expressions observed during periods of free and semi-free play in the MSPS is associated with communication and socialization skills as perceived by parents within each group.
Methods: 37 AS and 39 TD children aged between 24 and 72 months were exposed to the MSPS and filmed. Using the Noldus Observer software, two naïve raters coded the 76 videos and defined emotional expressions (positive, negative and unknown). Positive emotions were coded when the child smiled. Negative emotions were coded when the child cried or frowned. Unknown emotions were coded when there was a clear facial expression, but the rater was not able to categorize it as a positive or negative expression. 29% of the videos were double coded (K=0.33). Communication and socialization skills were assessed through parent interview using the second edition of the Vineland Adaptive Behavior Scale. Both groups were paired on age (p=.124).
Results: The variable "emotional expressions" represents the total number of times the child expressed each type of emotions (positive, negative, unknown) during the MSPS. There was no significant association between socialization skills, and emotional expressions in the TD group. In the AS group, results indicated a negative association between socialization skills and the frequency of unknown emotions (r=-.57, p<.05), explaining 32.9% of variance. No main effect emerged regarding the association between communication skills and emotional expressions, though there was a trend for a negative association with the frequency of unknown emotions (r=-.49, p=.074), explaining 24.2% of variance in the AS group. We conducted additional exploratory analyses to document whether each subscale of the socialization scale (interpersonal relationship, play and leisure, coping skills) was associated with emotional expressions within each group. The linear regressions revealed that there was only a significant association between the interpersonal relationship scale and the frequency of unknown emotions in the AS group (r=-.57, p<.05).
Conclusions: These preliminary results suggest that in this sample of AS children, greater deficits in socialization skills as perceived by parents, more particularly in interpersonal relationships, could be associated with higher frequency of unknown emotions during the MSPS. Our findings indicate that AS children may express emotions atypically which might, in turn, lead to a difficulty of TD individuals to correctly identify them. This association between atypical expression of emotions and incorrect identification of emotions by peers and/or parents may reduce the quality of social interactions.

223 **165.223** Autistic Traits Predict Weaker Sensitivity to Reward in Emotion Perception

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Background:
When we look at a person's face and try to infer what she is feeling, our interpretation is usually influenced by context (Barrett et al., 2011). One contextual factor that plays a significant role is utility, i.e. how useful it is to us to detect emotional changes. Recent advances in perception research indicate that individuals with autism spectrum disorder (ASD) show basic differences in how they process sensory cues. A common Bayesian explanation for these differences is that those with ASD rely more on immediate sensory information, while they appear to be less influenced by prior perceptual expectations (Pellicano & Burr, 2014). The forming of prior perceptual expectations could also be the psychological mechanism through which context modulates emotion perception. Yet it is unclear whether ASD is associated with a lower tendency to integrate context into emotion judgments.
Objectives:
The purpose of this study is to examine whether ASD-like traits affect how much individuals rely on personal utility when making emotion judgments. Using computational modeling we estimate how changes in facial cues and utility contribute to response bias in emotion judgments, and how these estimates are represented in brain activation.
Methods:
Forty-five healthy adults completed an emotional signal detection task while undergoing functional magnetic resonance imaging (FMRI). Participants were told a fictional background story in which the protagonist was just saying goodbye to his girlfriend for a day (neutral outcome) or for a year (sad outcome). Their task was to guess the emotional outcome based on facial expressions of the protagonist, morphed to convey varying degrees of emotional intensity. Utility was manipulated by offering rewarding and punishing payoffs for different response strategies, incentivizing in turn more liberal or more conservative response biases. After each trial, participants received feedback on their performance and the amount of money they gained or lost. We developed a computational model that extends a neural network model of criterion learning (Helie, 2014) with signal detection theory and prospect theory. This model estimates individuals' sensitivity to perceptual information, sensitivity to reward, and reward bias. We regressed participants' autistic traits as assessed by the autism spectrum quotient (AQ) against these parameter estimates. For FMRI analysis we entered them as parametric modulators into FMRI analysis.
Results:
Autistic traits predicted sensitivity to reward and reward bias, but not sensitivity to perceptual information. This effect was negative, with increasing autistic traits leading to a weaker role of reward. Reward sensitivity modulated brain activation in the striatal region. Stimulus sensitivity modulated brain activation in ventromedial prefrontal regions, striatal regions, and posterior midcingulate cortex.
Conclusions:
In line with our assumptions, ASD-like traits were associated with a lower reliance on utility. This could be a potential route to explaining why individuals with ASD often experience difficulties with perceiving emotional expressions. A weaker integration of reward context could signify that their interpretation of emotional faces is less flexibly adapted to situational needs. Emotional expressions are often embedded into a complex environment, which may make their interpretation particularly challenging for those with ASD.

224 **165.224** Autistic Traits and Symptoms of Social Anxety Related to Different Phases of Attention to Others' Eyes in Social Anxiety Disorder

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Background:
Autism spectrum disorder (ASD) and Social Anxiety Disorder (SAD) have partly overlapping symptoms. It is also increasingly acknowledged that both SAD and ASD can be understood as the extreme ends of continuous phenotypes. Elevated autistic traits are common in SAD, and people with ASD often have high levels of social anxiety. Studies relating symptom dimensions to cognitive mechanisms can therefore be informative about similarities and differences between the two conditions. Gaze avoidance has been linked to both SAD and ASD, but little is known about differences between the two conditions.
Objectives:
We examined the relationship between SAD and ASD symptoms and different stages of visual attention to human eyes.
Methods:
Participants: 25 treatment-seeking adolescents diagnosed with Social Anxiety Disorder (21 female). Social anxiety levels and autistic traits were assessed dimensionally. All participants were diagnosed by an experienced clinical psychologist. Data was first analyzed in females only, and then in the full sample.
Stimuli consisted of images of human eyes among non-social distractors. Images were presented in horizontal arrays. The position of the eyes were counterbalanced across trials. Gaze was recorded with a corneal reflection eye tracker.
Measures: Latency to first fixation at the eyes, and latency to orient from the eyes once they were fixated. Social anxiety was measured with the SPAI-C [2]. Autistic traits were measured with the SRS [2].
Results:
Controlling for social anxiety, elevated autistic traits were associated with delayed *orienting to* eyes presented among distractors ($p < .05$; see Figure 1A). In contrast, elevated social anxiety levels were associated with faster *orienting away* from the eyes, when controlling for autistic traits ($p < .01$; see Figure 1B). Both mechanisms typically operated within less than 1000 milliseconds.
Conclusions:
We found evidence of independent contributions by two aspects of social attention – orienting to and orienting away from eyes, to autistic traits and SAD symptoms, respectively. With regards to ASD, this study suggests that autistic traits are related to a reduced bottom-up driven salience of human eyes. In contrast, social anxiety mainly had an effect at later stages of processing, possibly reflecting anxiety-driven avoidance.
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225 **165.225** Autistic Vulnerability in Police Interviews: Compliance Vs. Suggestibility

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Background: People with autism spectrum disorder (ASD) display a characteristic pattern of social communication impairments that may make them more vulnerable to encountering the Criminal Justice System as a victim, witness or suspect. However it has been suggested memory and cognitive impairments may result in heightened *suggestibility* in ASD, while impaired social cognition together with issues such as self-esteem, anxiety and fear of negative evaluation may result in an increased tendency to be overly *compliant* with requests.
Objectives: To examine whether adults with ASD exhibt heightened suggestibiliy and compliance.
Methods: We report a series of studies utiising both experimental and self-report methods examining suggestibility and compliance in autistic adults and their age- and IQ-matched typically developed (TD) comparisons.
Results: Findings across two experiments indicated that autistic adults (with IQ in the normal range) are not more suggestible than TD adults. Findings regarding compliance were mixed: in Study 1, we found no difference in self-reported compliance between ASD and TD groups. Study 2 however found increased (informant-reported) compliance in ASD participants from a clinical sample referred for psychiatric evaluation, and Study 3 found increased ASD compliance in an experimental task testing compliance with an unreasonable request for participants' time.
Conclusions: Â It is important to consder the role of individual differences and psychological vulnerabilities to suggestibility and compliance in ASD.Â Findings have both theoretical and practical implications.Â Not only could a tendency towards over-compliance leave individuals with autism at increased risk of exploitation to enter the criminal justice system in the first instance, it also has a number of direct implications for obtaining evidence from them using different interview techniques. Leading or cued questions might result in heightened acquiescence, and interrogative, leading or coercive suspect interviewing techniques may result in false confessions.

226 **165.226** Brain Correlates of Self-Other Distinction Centred on Touch and Actions in Adults with High-Functioning Autism

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Background: Â It has been argued that patients with autism spectrum disorder (ASD) have problems to distinguish self from other when observing other people's behavior (Spengler et al., 2010). While there is some behavioral evidence that ASD patients slow down more strongly when performing an action while observing an incongruent action, this evidence is however far from being conclusive. When centred onÂ *tactile*Â *consequences*Â *of*Â observed actions and felt touch, neural evidence for self-other distinction problems in ASD was recently provided (Deschrijver et al., 2016a). So far however, neural evidence for self-other distinction problems centred on actions per se does not exists in ASD.
Objectives: By means of EEG, we assessed whether self-other distinction centred on actions was neurally disturbed in the group of adults with ASD that had shown impaired self-other distinction centred on tactile consequences of observed actions and felt touch in an earlier study (Deschrijver et al., 2016a). If so, we reasoned that their brain should not adequately signal when an observed action does not match an own action.
Methods: We employed the imitation-inhibition paradigm (Brass et al., 2000), in which participants observe a human hand lifting the index or middle finger while they are instructed to perform the same (congruent) or the opposite (incongruent) movement. Following our earlier EEG-studies (Deschrijver et al., 2016ab), we hypothesized that if self-other distinction centred on actions is impaired in ASD, we should observe a smaller congruency difference within the P3 in adults with ASD as compared to a matched control group.
Results: The ASD group did not show diminished neural signaling of observed actions that do not match own actions, as reflected in an intact P3- congruency effect within the imitation-inhibition task. As such, we did not find evidence for disturbed self-other distinction centred on actions in our group with ASD. Instead, we found evidence for disturbed motor preparation processes within the readiness potential.
Conclusions: Self-other distinction centred on actions may be preserved in individuals with ASD, while self-other distinction centred on tactile consequences of observed actions and own touch may not. The sense of touch and motor preparation processes may play a more crucial role for social cognition in ASD than previously thought.

227 **165.227** Changes over Age in Eye-Gaze Pattern in ASD from Childhood to Adolescence: A Cross-Sectional Eye-Tracking Study

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Background: Deficits in social interaction, notably difficulties to establish a direct eye-contact, are a core characteristic in ASD. Thanks to eye-tracking methodology, eye-gaze behavior, crucial for human interaction, can be measured objectively. It is now well documented that persons with ASD, adults and children, met a specific eye-tracking pattern when they passively view a dynamic social scene. Indeed, compared to individuals with typical development (TD), persons with ASD present less interest for facial cues conveying social indices useful to understand the main running social scene and they present more interest to background non-social details. To our knowledge, no study has demonstrated changes linked to age of this eye-gaze pattern in ASD and TD children using the same stimuli and across a large and representative cohort extending from infancy to adolescence.
Objectives: In this context, the current study sought to investigate (i) whether individuals with ASD exhibit differences in eye-tracking pattern compared to TD children; and (ii) how this eye-gaze pattern could change with age during the childhood and adolescence period in ASD and TD children.
Methods: Forty-four children with ASD (age = 8.7 ± 3.7, range: 2.3-16) and forty-six TD children (age = 9.5 ± 3.5 range: 2.6 -17.9) participated in this study. ASD diagnosis was based on DSM IV-R and ADI-R criteria. Tobii-T120 eye-tracker was used to measure eye-gaze processing during passive visualization of social movies displaying characters engaged in peer to peer social interactions (Saitovitch et al., 2016). Viewing time was measured in areas with strong social contents (face-region) and in non-social areas (background-region). Firstly, viewing time was compared between ASD and TD children. Subsequently, a correlation analysis was performed between age and viewing time to the face or background-region. For both analyses we used linear regression model.
Results: Compared with TD children, children with ASD had significantly reduced viewing time to the face-region ($p<0.001$) and significantly increased viewing time to the background non-social region ($p<0.001$). Moreover, for children with ASD, we described a significant positive correlation between viewing time to face-region and age ($p<0.001$) as well as a significant negative correlation between viewing time to the background non-social region and age ($p<0.001$). For TD children, viewing time toward facial and background non-social regions remains stable and invariant across the period studied (*interaction group: age* $p<0.05$). Actually, quasi all TD children, independently of their age and since the early infancy, fixed the face-region more than 80% of the social movie duration and the background-region less than 20%.
Conclusions: The present cross-sectional study confirmed differences in viewing time to face and background non-social region between ASD and TD children. Furthermore, we present for the first time a correlation between age and viewing time to face and background-region in children with ASD that could reflect an adaptation and learning process. We can suppose that fixation to face is innate in TD children whereas for children with ASD it constitutes a learned behavior that change with age. Longitudinal studies are needed to confirm these results.

228 **165.228** Children with ASD and Their Siblings: A Detailed Analysis of Sibling Interactions Using a Micro-Analytic Computerized Methodology

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Background: Sibling relationships are often the longest and most significant relationships a person has in life, with the potential to deeply influence personality, social and cognitive skills (Boer, Dunn, & Dunn, 2013; Gass, Jenkins, & Dunn, 2007). Research on the development of typically developing (TD) young children highlight the significant role of sibling interaction as one of the most enhancing contexts for acquiring communicative and social skills (Brody, 2004; Dunn, 1992). Considering the fact that communicative-social impairments are fundamentalÂ in ASD, and the role that TD siblings of children with ASD play on their sibling's development (Ben-Yitzhak & Zachor, 2016) the paucity of research on these children's interaction with their siblings is striking.
Few studies compared sibling interaction where one sibling has ASD with interaction between TD siblings, or pairs where one sibling has a disability other than ASD (Kaminsky & Dewey, 2001; Knott, Lewis, & Williams, 1995; 2007). Rather than compare groups on the basis of average data, in the current study we aim to examine in detail the characteristics of sibling interaction in a within-subject design.
Objectives: Frame by frame analysis of sibling interactions in which one sibling is diagnosed with ASD.
Methods: The primary participants were 10 children with ASD (ages 5-10). Each child was visited at home and video-recorded for about an hour during interactions with: 1) an older TD sibling; 2) the mother, and with each partner data was collected in three activities: 1) a collaborative construction game; 2) while reading a book together; and 3) during play with a familiar toy. The order of tasks and partners were counterbalanced.
Twenty-four video recordings were systematically analyzed utilizing *Interact* software (a total of 12 hours) according to a set of categories for analysis. In addition, for each partner we coded whether he\she was on or off task, and qualitative remarks regarding joint engagement were noted.
Results: Sibling interactions were mostly positive, and consisted of pro-social, play-related, and discourse actions. Interactions of ASD children with their siblings were more reciprocal balanced and less agonistic than the interactions with their mothers. Episodes of joint engagement were demonstrated in all dyads: More and longer joint engagement episodes were recorded for children with ASD in sibling interactions than with mothers. In some cases of sibling interaction, joint engagement was demonstrated for almost all of the observation period.
Conclusions: The frame-by-frame analysis revealed indices of better social skills in children with ASD during sibling interaction. This finding is important mainly due to the need to evaluate the social-communicative potential of children with ASD, who often fail to interact with unfamiliar examiners, and do not always fully cooperate with standardized testing. Results have also implications for social intervention programs for children with ASD. Detailed description of siblings' interaction highlight strategies for enhancing communicative skills of children with ASD.

229 **165.229** Clinician-Derived Social Profiles Predict Play and Friendships with Peers in Children with Autism Spectrum Disorder

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Background:
Children with autism exhibit deficits in peer play and social relationships, but there is great variability across individual children's abilities in these areas. The severity and presentation of restricted/repetitive behaviors also vary across individuals, and there is a lack of information on the direct impact of these behaviors on peer interactions (McConnell, 2002). The heterogeneity in social skills and atypical behaviors makes it difficult to develop targeted treatments that address the challenges children with autism experience in peer play and friendships.
Objectives:
To examine the social profiles of children with autism based on clinician-child interactions in a large, well-characterized sample in order to predict parent-reported quality of peer play and friendship.
Methods:
Utilizing data from the Simons Simplex Collection (SSC), our participants included 1571 children (11.2% female) with ASD between the ages of 4 years and 17 years 11 months (M = 9.75 years, SD = 3.14 years) who completed the Autism Diagnostic Observation Schedule (ADOS) Module 3. We created five social profile composites based on select ADOS items: (1) Social Approach, (2) Social Response, (3) Reciprocity, (4) Nonverbal Behaviors, and (5) Atypical Behaviors. Quality of peer play and friendship was assessed using items from parent-reported responses on the Autism Diagnostic Interview-Revised (ADI-R). We conducted a series of simple linear regressions to determine whether social profile related to peer play and friendship. Second, we added socioeconomic status (SES), Full-Scale IQ, and age to the regressions to account for individual predictors. Finally, we converted each continuous outcome to a binary outcome and ran binary logistic regressions to determine how well our social profiles predicted the quality of peer play and friendship.
Results:
Out of the five social profiles, Social Approach was significantly related to quality of peer play (ß=.08, p=.030), and Atypical Behaviors was significantly related to quality of friendships (ß=.097, p<.001). When considering individual predictors, SES was significantly related to quality of peer play (ß=.08, p=.030), and both FSIQ (ß=-.087, p=.001) and age (ß=.060, p=.020) were significantly related to quality of friendships. A binary logistic regression showed Social Approach was marginally significant in predicting aberrant behaviors in peer play (ß=-.364, p=.064), and Atypical Behaviors significantly predicted aberrant behavior in friendship (ß=-.301, p<.001). Adding individual predictors strengthened the model ($\chi(3)=23.28$, p<001).
Conclusions:
These findings suggest that aspects of social functioning observed in clinician-child encounters may predict quality of peer interactions. Of the five social profile composites, social approach predicted quality of peer play and atypical behaviors predicted quality of friendships. Because initiating interactions is the first step in engaging in peer play, increased difficulties with social approach may impact play negatively. The repetitive behaviors, restricted interests, and sensory needs common in children with autism may inhibit social engagement and, subsequently, interfere with the formation of friendships. Using a large sample and information from a widely-utilized diagnostic assessment, this study provides insight into which specific aspects of social competence should be targeted in ASD interventions.

230 **165.230** Comparing How Autistic and Non-Autistic Adolescents Describe Their Relationships with Friends, Family Members and Teachers: Less Need to Pretend but More Superficial Evaluations of Friendship

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Background: Autism-related social difficulties worsen in adolescence (Locke et al., 2010). Autistic adolescents encounter changes in peer culture and relationships with adults (Carter et al., 2013). Studies showing that autistic adolescents have fewer and qualitatively different friendships have not examined the broader context of their relationships with other significant people (Sedgewick et al, 2015). This study extends our work demonstrating that autistic adolescents in Japan report less closeness with friends and greater reliance on adults by administering similar measures to a sample in NYC.
Objectives: Examine how adolescents with and without ASD perceive their relationships with friends, family and teachers.
Methods: Thirty-two adolescents completed an online survey: typically developing (TD)= 14 (5 girls); ASD= 18 (5 girls); (TD age: *M*=13.64; ASD age: *M*=13.28, *p*=.59). Measures included the Friendship Qualities Scale (FQS; Bukowski et al.1994), the Japanese Friendship Scale (Otani, 2007), The Inventory of Parent and Peer Attachment-Revised (Gullone et al., 2005), the Intolerance of Uncertainty Scale (Carleton et al., 2007) and a ranking of how likely they were to seek advice from their father, mother, brother/sister, teacher, friend and "other". Open-ended responses to "How do you know when someone is your friend?" were scored into non-mutually exclusive categories: companionship, intimacy, and affection (Bauminger & Kasari, 2000), superficial explanations, and shared interests.
Results: No group differences on the FQS were observed (*p*=.65), The Japanese Friendship Scale revealed that autistic adolescents more often *disagreed* that they could *not* express their true selves with friends (*p*=.006). They also reported higher uncertainty avoidance (*p*<.05). Less need to hide one's true self and heightened uncertainty avoidance were dimensionally associated with autistic traits (*p*<.001). Attachment to parents did not differ (*p*=.96).Â Autistic participants reported seeking help from teachers more and from siblings less than TD participants (*ps*<.04). Chi square tests revealed no differences in how often autistic and non-autistic participants included companionship, intimacy, affection, or interests as friendship indicators. However, 10 autistic participants provided superficial indicators of friendship (e.g., "when they help me in school") while none of the TD participants did (*p*<.001). Length of these explanations did not differ (*p*=.37).
Conclusions: Like autistic adolescents in Japan (Nishio & Torii, 2016), autistic adolescents in NYC sought advice from teachers more than non-autistic youth. Autistic adolescents may compensate for challenges with peers by remaining closer to adults.Â Unlike Japanese adolescents, autistic adolescents in NYC did *not* report more attachment to parents or friendship difficulties relative to non-autistic peers. The latter may be attributable to how autistic and non-autistic people decide if someone is a friend. Autistic people may use more superficial indicators (Whitehouse et al., 2008). Autistic people and those with heightened autistic traits reported less need to hide their true selves from friends. Trainings to encourage youth to befriend autistic people could emphasize their honesty. Interventions for autistic adolescents should provide opportunities to practice evaluating the depth of friendship and the degree of self-disclosure that is likely to be effective, and practice communicating with siblings.

231 **165.231** Comparing Mother-Child and Father-Child Emotion Co-Regulation Processes in Relation to Adaptive Functioning in Children with ASD

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Background: Emotion regulation plays a crucial role in the development of adaptive skills. Emotional dysregulation, while not a core deficit of ASD, is frequently observed among children with ASD and contributes to problems in social interaction. Emotion regulation abilities facilitate the development of emotional functioning and long-term adaptive skills (Gross, 1998, 2007). Parent-child co-regulation lays the foundation for future self-regulation in children although more is known about mother-child than father-child interaction. The current study compared micro-level positive and negative emotion co-regulation processes between mother-child and father-child dyads in relation to the adaptive functioning of children with ASD.
Objectives: To compare mother-child and father-child emotion co-regulation processes, examined using a dynamic systems approach, in relation to children's adaptive social functioning.
Methods: Forty-four mother-child and father-child dyads [(75% boys; *M*age = 5.37, *SD*=1.42 years) were videotaped during a semi-structured, 10-minute Three Boxes (Vandell, 1979; NICHD, 1999) play procedure at home. The children were 44% European American, 15% Asian/Asian American, 24% Hispanic/Latino, and 17% multiethnic or other. Clinical reports, the Social Communication Questionnaire (Rutter, Bailey, & Lord, 2003), and ADOS-2 (Lord et al., 2012) were used to screen and diagnose ASD. Positive and negative emotion regulation processes in dyadic mother-child and father-child interaction were coded in 5-second intervals using INTERACT 9.47 software (Mangold, 2007). Intercoder agreement exceeded .90. The observation data were imported into the State Space Grid (SSG) software (Lamey, Hollenstein, Lewis, & Granic, 2004) to operationalize the structure of emotion co-regulation indicated by *dispersion* (an index of spread of emotional states) and the content of emotion co-regulation indicated by *mutual positive interaction* and *mutual negative interaction*. The dependent variable was the *adaptive composite* scale from parent reports on the Vineland Adaptive Behavior Scales-II (Sparrow et al., 2005). OLS regressions were used to analyze the data with age of child controlled.
Results: Children were reported to have higher adaptive functioning when they were observed to have less dispersion in their emotion states with their mothers (beta=-.42, *p*<.05) and fewer mutually negative emotion states with their mothers (beta=-.66, *p*<.01); the corresponding father-child variable were not significant. Children with ASD showed greater adaptive functioning when they had proportionally more mutually positive emotion states with their fathers (beta=.32, p<.05). Children's adaptive functioning was lower when parent-child states were mismatched such that children were in negative emotion states while either parent was in positive ones (mother-child dyads- beta=-.30, p<.05; father-child dyads- beta=-.26, p<.10, marginal).
Conclusions: To our knowledge, the current study is the first to compare the emotional structure and content of interaction in dyads of children with ASD and their mothers and fathers using the State Space Grid method. Mother-child emotion regulation processes were more frequently associated with children's Vineland scores than were father-child processes. However, valences differed in their importance for children: Negative interactions with mothers and positive interactions with fathers were most salient for children's adaptive functioning.

232 **165.232** Conditional Probabilities of Dynamic Visual Scanning Quantify Altered Pathways of Learning in Toddlers with Autism Spectrum Disorder

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Background: Perceived stimulus salience and learning are tightly linked: attending to a particular stimulus at a given moment may result in learning that impacts where one chooses to look in the future. Likewise, *not* attending to that stimulus may lead to a different pathway of learning, resulting in different future fixations. Despite reports that children with Autism Spectrum Disorders (ASD) attend to social scenes differently than typically-developing (TD) children (Shultz et al., 2011), studies have not examined conditional probabilities of dynamic visual scanning, that is, the probability that viewers will fixate a particular location given viewers' previous fixation locations. Investigating the conditional probability of fixations may reveal what is learned and what is missed by children with ASD.
Objectives: This study characterizes learning pathways in toddlers with and without ASD by identifying on-screen fixation locations that predict future fixation locations.
Methods: Eye-tracking data were collected from 81 toddlers with ASD (mean age=24.1(1.7) months) and 75 TD toddlers (mean age=24.6(0.9) months) while viewing clips of naturalistic peer interactions. Fixation targets were defined as characters or objects perceived as highly salient (indexed by timepoints when most viewers looked at the same location; Figure 1a-b). Targets were identified separately for TD and ASD groups ('TD targets' and 'ASD targets'). Conditional probability ratios were calculated for all target pairs as the proportion of viewers who fixated on initial target X *and* later target Y relative to those who fixated on Y but *not* X (Figure 1c). *Conditionally dependent* target pairs had conditional probabilities above 1.0, indicating targets were *more* likely to be fixated on had viewers looked at specific locations, and were *less* likely to be fixated on had viewers *not* looked at those earlier locations. Conditionally dependent target pairs were identified for TD viewers fixating on TD and ASD targets, and for ASD viewers fixating on ASD and TD targets.
Results: Conditionally dependent target pairs were identified for TD and ASD viewers, indicating that viewing patterns of both groups are influenced by past viewing experience. Interestingly, TD fixations on TD targets appeared to be more strongly influenced by previous viewing experience compared to ASD fixations on ASD targets: a greater number of conditionally dependent target pairs were identified for TD viewers and the conditional probabilities of identified pairs were higher for TD (mean=5.33(10.40)) than for ASD viewers (mean=3.17(3.15)). When TD toddlers fixated on ASD targets, conditional probabilities were lower than when fixating on TD targets (mean=2.66(2.60)), suggesting that TD fixations are less strongly influenced by fixation locations perceived as salient by ASD viewers. By contrast, conditional probabilities were comparable when ASD viewers fixated on ASD compared with TD targets (mean=3.17(3.15), mean=3.19(3.63), respectively), suggesting ASD fixations are similarly influenced by TD and ASD targets.
Conclusions: In navigating the social world, current understanding depends on past experiences, as information conveyed in past fixation locations may influence future viewing. Calculating conditional probabilities of dynamic visual scanning provides a novel means of quantifying how learning shapes and is shaped by altered patterns of visual engagement in ASD.

233 **165.233** Culture-Specificity and Generalisability of Factors That Affect Vocal Modulation during Conversation: The Role of Autistic Traits

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Background:
Vocal modulation is a critical component of interpersonal communication. It not only serves as a dynamic and flexible tool for self-expression and linguistic information but also functions as a social tool. Autism Spectrum Disorders is often associated with a lack of appropriate vocal modulation, with several reports of a 'monotonic' style of speaking. Vocal modulation can also be affected by the relationship between the two interactants, such as interpersonal closeness. We speak differently with our friends vs strangers. Cultures across the world are associated with established differences in display rules for facial and vocal expressions. The extent of culture-specificity in the impact of these factors on vocal modulation remains largely unknown, and can contribute to differential manifestation of autism-related symptoms.
Objectives:
To investigate the impact of autistic traits and interpersonal closeness on vocal modulation during a real two-person conversation, in three countries (India, UK, and Italy).
Methods:
85 same-sex pairs of participants were tested in all, by being recorded during a conversation about an abstract painting. The articulation area of the speech modulation spectrum was extracted using the method developed by Singh and Singh (2008). This area for each speaker was correlated with the self-reported perceived closeness to the other member of the pair and with the individual Autistic Quotient (AQ).
Results:
Results indicated a significant positive correlation between interpersonal closeness and articulation area in all three countries (India: $r=0.43$, $p<0.01$; United Kingdom: $r=0.35$, $p<0.01$; Italy: r=034, $p<0.05$). A significant negative correlation between AQ and articulation area was observed only in the UK sample only($r=-0.23$, $p<0.05$), but not seen in the other countries.
Conclusions:
The positive relationship between interpersonal closeness and vocal modulation was observed in all three countries, suggesting cultural generalisability of this result. In contrast, autistic traits were negatively associated with vocal modulation only in the UK sample. This observation could be driven by differences in baseline levels of vocal modulation in different cultures, which can lead to potential culture-specificity in the manifestation of autistic traits.

234 **165.234** Deficit in Emotion Recognition in High Functioning Autism Spectrum Disorder

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Background: The ability to recognize emotions is a core deficit of ASD, and difficulty in understanding other people in everyday interaction is widely reported in the individuals with this syndrome. However, the exact nature of the emotional deficits in ASD remains unclear. To date, probably due to the different matching criteria for control group, stimulus type and task demands, no agreement in the investigation of the deficits in recognizing emotional expression in ASD has emerged. Also, the comprehension of social meaning across different communicative channels is still widely unexplored.
Objectives: The aim was to investigate the ability of individuals with high-functioning (HF) ASD in recognizing emotions across a range of different social signals.
Methods: Participants were 20 adults with HF ASD and 20 controls matched for non-verbal IQ, age and gender. They were asked to categorize 24 images of faces, 24 images of whole body, and 30 video clips of Full-light (FLDs) and 30 Point-light display (PLDs) of whole body movements depicting emotional expressions (fearful and happy) or neutral actions. Accuracy and response times (RT) were recorded.
Results: Within group logistic regression analysis showed that, in participants with ASD , the accuracy relative to fearful stimuli was significantly lower in PLDs than in FLDs (p = .01), body images (p = .002) and marginally face (p = .05). Regarding the recognition of happiness, the accuracy in face was higher than that of body images (p = .03), FLDs and PLDs (p = .001). In TD group there was not any difference across emotion neither for face nor for body images recognition. When the two groups were compared, no significant group difference emerged in accuracy in all the classes of stimuli (all p > .2). Repeated measures ANOVAs for the RTs revealed an interaction effect between class of stimuli and emotions (F(2,38) = 4.14, p = .02): fearful faces were recognized by ASD subjects faster than fearful bodies (p = .003) and neutral faces were recognized faster than neutral bodies (p = .001). In TD subjects, no effect of display or emotions were found. Between group comparison showed no group difference in static stimuli (face and body images) (F(1,38) = 0.100, p = .753), while participants with ASD were slower than TD in recognizing dynamic body movements (FLDs and PLDs) (F(1,38) = 5.202, p = .028).
Conclusions: The findings show that individuals with HF ASD are as accurate as TD in recognizing the emotional content of faces and body movements, both static and dynamic. On the contrary, HF ASD were slower than TD in recognizing dynamic body movements, but not static stimuli. Our results are in contrast with prior studies highlighting deficit in face perception in ASD population. Besides, our data reveal a specific difficulty in processing the body movement from dynamic stimuli. Accuracy and RTs did not vary according to the emotional content, in any of display conditions. The ASD impairment in social interaction could be related to the processing of human movement rather than to the recognition of emotion.

235 **165.235** Deficits in Emotion Processing Ability Predict Autistic Traits in Children: Eye Tracking Results from a Retrodictive Mindreading Task

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Background: Â Research presents conflicting results regarding whether autistic traits are associated with emotion processing abilities (Harms, Martin and Wallace, 2010), or reduced attention to the eyes of faces (Cassidy *et* al. 2014; Jones and Klin, 2013; Jones, Carr and Klin, 2008). Inconsistent findings highlight the need to revisit experimental procedures; including the use of stimuli with more naturalistic responses.
Objectives: Â 1) To establish whether retrodictive mindreading (RM) ability predicts autistic traits; and 2) To establish whether visual perusal patterns predict autistic traits.
Methods: Â 38 children without ASC (18 males, 20 females; mean age (8.99 years), SD=19.24, range 72 months – 153 months) took part in a RM emotion task. This involved participants observing short video clips of people reacting to one of four prompts (being asked a difficult maths question, being given monopoly money, being given negative feedback and being given positive feedback), and subsequently guessing which prompt caused the reaction, and how the person felt. Participants' visual perusal patterns were recorded via the Tobii eye tracker, and participants' parents completed the Autism Spectrum Quotient child version (AQ).
Results: Â A one way ANOVA showed that certain prompt types were more accurately recognised than others (F(2.40, 79.26)= 28.202, p<0.001). Post hoc Bonferroni corrected t-tests showed that responses to the maths question and monopoly money were significantly more accurately recognised than the negative and positive feedback prompts (p<0.001). There were no significant differences in the recognition rates between maths question and monopoly money (p=1), or negative and positive feedback (p=1). Recognition rates did not significantly predict AQ scores for any of the prompts (p>0.05). A multiple regression analysis was conducted with AQ scores as the outcome variable and RM ability, eye-mouth ratio and face-body ratio as predictors. The model was a significant predictor of AQ scores (F(3,28)=3.562, p = 0.027, adj. R^2 = .20), with total correct RM (p=0.02) a significant predictor. Looking to the face of the body (p=0.058) and eyes of the face (p=0.058) were borderline significant predictors.
Conclusions: There were significant differences in the recognition rates of the different expressions, but this did not independently predict AQ scores. Results of the multiple regressions suggest that RM ability is associated with autistic traits. More time spent looking at the body also approached significance as a predictor of autism traits. Contrary to some claims the more time spent viewing the eyes relative to the mouth was suggestive of higher autistic traits, however this result was borderline significant. These results suggest autistic traits are related to difficulties in RM and by extension emotion processing, and do present with altered viewing patterns. There are implications for future research considering the stimuli used and if this accurately replicates naturalistic social responses allowing valid recognition testing and visual perusal. These results need to be replicated in a sample with confirmed ASC diagnosis.

236 **165.236** Deficits in Social Awareness & Social Motivation Associated with Increase in Aggression in ASD

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Background: Â Aggressive behaviors, directed either toward the self or others, can cause severe psychological and physical damage to an affected individual, family, and others in the affected individual's environment (De Giacomo et al 2016).Â Prior research has shown that, in individuals with ASD, language skills and cognitive functioning are associated with these behaviors (Dominick et al, 2007).Â Research has also noted that individuals with ASD show deficits in their ability to notice and act on social cues (Vivanti et al, 2011) and that they engage in reduced social interactions. No study to date has looked at the relationship between aggressive behaviors in children with ASD and these two social domains.v
Objectives: Â We used two scales of the Social Responsiveness Scale (SRS): Social Awareness, which measures the ability to pick up on social cues, and Social Motivation, which measures the extent to which an individual is motivated to engage in social-interpersonal behavior (Constantino and Gruber, 2005), to assess whether deficits in either of these areas are associated with increased presence and level of aggressive behavior. We hypothesize that children with higher Social Awareness scores will present with increased aggressive behaviors, and that Social Motivation is not necessarily associated with aggressive behaviors.
Methods: A sample of 307 children (53.7% male) with research confirmed ASD diagnosis using ADOS and ADI-R were examined. Participant ages ranged from 46 months to 224 months (Mean= 124.38, SD= 40.481). IQ was measured with the Differential Ability Scales. Pearson correlations between Social Motivation, Social Awareness (SRS) and Aggressive Behaviors (Child Behavior Checklist, CBCL) were examined. We fit a regression model to examine the relationship between Social Motivation, Social Awareness, and Aggressive behaviors controlling for NVIQ and Age.
Results: Both Social Awareness and Social Motivation were correlated with Aggressive Behaviors (Social Awareness r=.364, p<.000; Social Motivation r=.304, p<.00). There was a significant, positive relationship between Aggressive Behaviors and Social Awareness (p<0.000) but not between Aggressive Behaviors and Social Motivation (p>0.05), after controlling for age and IQ. Specifically, for every additional point on the Social Awareness scale on the SRS, there is, on average, a .26 increase in the CBCL Aggressive total (Awareness Beta = .267, p<.000), after controlling for Age, NVIQ, and Social Motivation. Social Motivation, Social Awareness, Age, and IQ, taken together, account for approximately 21% of the variation in Aggressive behaviors (Adjusted R Square =.209). Age has a negative relationship with the Aggressive Behaviors total of the CBCL, indicating that for each additional month of age, an individual's aggression level decreases by .067 points, on average, after taking into account our other variables.
Conclusions: Our findings indicate that it may be the reduced capacity to notice social cues and not the lack of motivation to engage in reciprocal social motivation that is associated with increased aggressive behaviors. We believe that future research is needed to discover additional variables that account for the remaining variation in aggression.

237 **165.237** Defining Domains of Social Functioning in Adults with Autism Spectrum Disorder As Targets for Treatment

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Background: There is increasing recognition of the need to develop treatments for adults with autism spectrum disorder (ASD) to improve their social functioning, a key factor in adults' employment, relationships, and overall quality of life (Howlin et al., 2013; Shattuck et al., 2012).Â However, little is known about the relative level of impairment in various behavioral domains underlying social functioning, or about the relationship among these behavioral domains in adults with ASD.Â To our knowledge, previous studies have not measured these social behavior domains in the same sample of adults with ASD, which makes it difficult to know which domains should be targeted by treatments and how to best track treatment response. In this study, adults with ASD completed multiple measures in each of four domains underlying social functioning: social motivation, social anxiety, social cognition, & social skills. We hypothesized there would be a high degree of correlation among measures within the same domain (i.e. convergent validity), and more modest degrees of correlation among measures across domains, indicating only a modest relationship among these domains, and the need for multidimensional treatment approaches.
Objectives: To assess behavioral domains underlying social functioning in adults with ASD, and measure correlations among measures within and between these behavioral domains. This analysis will help determine whether multidimensional treatment approaches are warranted, and will provide a baseline profile of these domains in adults that can be used for tracking treatment response.
Methods: Participants were enrolled in a pilot study of a new cognitive behavioral treatment program, TUNE In, Training to Understand and Navigate Emotions and Interactions. At baseline, twenty-nine adult participants with ASD (Table 1) completed multiple measures in each of four behavioral domains, as well as measures of overall ASD phenotype and measures of community social functioning. The raw scores of some measures were inverted so that higher scores indicated greater impairment in all measures. Then, raw scores for each measure were converted into standard scores, and bivariate correlations between scores were analyzed using SPSS. To correct for multiple comparisons, significance thresholds were set at a false discovery rate of 10%.
Results: There were statistically significant, robust correlations among measures within each domain, with the exception of social cognition and community functioning (Figure 1). Measures of social motivation were significantly correlated with measures of all other domains, except for social cognition. Additional significantly strong cross-domain correlations were found between measures of anxiety & ASD phenotype; measures of social skills & community functioning; and measures social skills & ASD phenotype.
Conclusions: There are significant correlations among measures within and between behavioral domains underlying social functioning in adults with ASD. Social motivation, in particular, is highly correlated with all domains, except social cognition. However, the variability among the participants in each measure and the lack of robust correlations between all domains suggest a need for multidimensional service strategies that can target the particular domains of social functioning most in need of improvement in each individual with ASD.

238 **165.238** Developmental Trajectories of the Attunement of Visual Salience in Infants at High-Risk for ASD with Varying Levels of Affectedness at Outcome

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Background: Infants actively shape their environment by directing their attention towards content that they perceive to be most salient. From birth, typically developing (TD) infants are already remarkably attuned to the social world, displaying preferential attention to people. By selectively attending to socially adaptive signals, TD infants create opportunities for social learning that further refine their attention towards those stimuli with greatest relevance to their developmental goals. In contrast, reduced interest in the social world—a hallmark of Autism Spectrum Disorders (ASD), observed already by the second month of life—may lead to increasingly atypical development and schemas of salience. By dynamically assessing group agreement in allocation of visual resources within particular contexts over the first two years of life, this study examines how deviation from typical norms may yield increasingly divergent schemas of salience during infancy. Analyses were performed in infants at high-risk for ASD to examine the impact of deviations from typical norms dimensionally across the full spectrum of social ability to disability.
Objectives: To map developmental trajectories of attunement of visual salience in infants with varying levels of social disability.
Methods: Longitudinal eye-tracking data were collected from children at high-risk for ASD at 10 time points between 2 and 24 months of age. Participants watched naturalistic videos of caregivers and toddler interactions. Diagnostic evaluations at 24 and 36 months identified high-risk infants who: were clinically unaffected (HR-UA; N=33), exhibited subthreshold symptoms of ASD (BAP; N=19), or received a diagnosis of ASD (N=24). Allocation of visual resources was quantified by kernel density analysis at each movie frame in a sample of 24-month-old TD toddlers (N=79) to create a moment-by-moment map of normative salience in relation to movie content. This process was then repeated for HR-UA, BAP, and ASD infants at each longitudinal time point. The salience maps of TD 24-month-olds were used as a baseline for comparison of salience maps generated in HR-UA, BAP, and ASD infants.
Results: Results showed graded effects by outcome, with HR-UA infants displaying the greatest attunement to features perceived as salient by TD 24-month-olds and infants with ASD showing the least attunement to such features. Preliminary results indicate that HR-UA infants' moment-by-moment deployment of dyadic attention to eyes and mouths is synchronized with that of TD 24-month-olds by as early as 7 and 9 months of age, respectively. By contrast, BAP infants showed delays in reaching these milestones for dyadic eyes and mouth (and never reached baseline levels for attention to peer faces), while ASD infants failed to reach all milestones except for dyadic attention to mouths (delayed by 3 months).
Conclusions: This research demonstrates that deviations from typical trajectories of visual attention are associated with greater social disability at outcome in infants at high-risk for ASD. By failing to deploy attention in a manner that provides experiences that are important for social learning, BAP and ASD infants are learning about the world in very different ways, leading to increasingly atypical trajectories of learning and development.

239 **165.239** Developmental Trajectory of Theory of Mind Abilities in Children with Autism Spectrum Disorder

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Background: Â Although theory of mind (ToM) impairments in children with Autism Spectrum Disorder (ASD) have been widely researched, the developmental trajectory of these skills is unclear. Research has indicated that ToM ability in children with ASD may follow a similar course of development, but at a slower rate compared to neurotypical (NT) children (Steel et al., 2003). However, there is evidence that children with ASD may have a unique trajectory where skills progress in a different sequence (Peterson et al., 2012) or even plateau (Ozonoff & McEvoy, 1994).Â These conflicting findings may be due to variance in children's linguistic abilities and task complexity.
Objectives: Â Using the Developmental Trajectory approach (Thomas et al., 2009), we sought to understand (1) whether differences in performance on a range of ToM skills (first-order to higher-order) between children with and without ASD are due to a delay in onset and/or a difference in the rate of development, and (2) whether these mentalizing abilities are better explained by age or language ability.
Methods: This study compared the ToM ability of 19 children with ASD to 26 NT children (7-12 years of age). Children completed a battery of ToM measures, including: (1) the Unexpected Contents Task (first-order false belief; Perner et al., 1989), (2) Birthday Puppy Story (second-order false belief; Sullivan et al., 1994), (3) Strange Stories (higher-order ToM; Happé, 1994), and (4) the Frith-Happé animations (higher-order ToM; White et al., 2011). Children were matched on age, nonverbal-reasoning, and receptive language (Table 1).
Results: Â Across all ToM measures, children with ASD scored lower than NT children, indicating greater challenges with ToM (Table 1). Using the Developmental Trajectory Approach, we contrasted comparisons between groups' ToM trajectories, plotted according to chronological age (CA) with those plotted according to verbal mental age (VMA).Â Looking at the relations between VMA and ToM, children with ASD had a delay in onset of ToM development compared to NT children across all ToM measures. VMA was predictive of performance on all ToM tasks in children with ASD, but only predicted the rate of growth on the Strange Stories Test for NT children. Overall, CA predicted performance on the Unexpected Contents Task and the Frith-Happé animations. However, children with ASD showed growth on these ToM measures whereas NT children's performance did not change with their CA. CA was not related to performance on the Strange Stories Test or the Birthday Puppy Story in either group.
Conclusions: Â In line with past research (Steel et al., 2003), children with ASD showed significant improvement in ToM ability with increasing VMA, and in some instances CA. CA appeared to play a greater role in performance on tasks that required less language comprehension (e.g., Unexpected Contents) in children with ASD.Â However, the rate of growth in ToM ability differed between groups (i.e., ToM ability in NT children was less affected by CA and VMA). Taken together, these findings provide evidence that the development of ToM in children with ASD may be both delayed *and* deviant compared to NT children.

240 **165.240** Do Adolescents with Autism Use Task-Irrelevant Facial Expressions of Threat to Adapt Their Behaviour?

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Background:
Autism spectrum disorders (ASD) are characterised by significant atypicalities in the affective domain and research suggests that they process or react to social cues differently from typically developing (TD) individuals. The roots of such difficulties are still debated but it has been suggested that either difficulties in processing the emotional cues themselves or/and dysfunctions in the mechanisms underlying the preparation of appropriate response behaviour to perceived social signals, could play an important role in these social deficits. Recently, we demonstrated that adolescents with ASD can accurately process emotional displays (Ioannou et al. under review) while taking into account contextual information (gaze direction). These results suggest the possibility that significant difficulties in social interaction and communication seen in ASD may exist independently of their ability to process the social signals themselves.
Objectives:
The present study moves a step further by addressing whether, when decoding skills appear preserved, adolescents with ASD can exploit social cues adequately during real-life social interactions to adapt their behaviour.
Methods:
To address the question of how emotional signals impact action decisions, we use ecological stimuli developed by Vilarem et al. (in preparation) reproducing a complex social environment, i.e. a waiting room with four seats, two of which are occupied by two task-irrelevant individuals, one with a neutral expression and the other with either a neutral, angry or fearful expression of varying intensity. Fearful and angry displays, while both indicating the presence of a potential threat in their environment, differ in their social functions, and, as research suggests, are associated with different approach or avoidance tendencies. Of interest here, neuro-typical adult participants, when requested to make spontaneous, free action choices between non-emotional targets (empty seats), they choose more often to avoid individuals with an angry expression, by selecting the chair on the opposite side of the scene, next to the neutral face and to approach individuals with a fearful expression, by selecting to sit next to the fearful person.
In the present study, 25 adolescents (12-17 yrs old) with ASD and 25 age-, gender-, IQ- matched TD controls will be tested using an adapted version of the above spontaneous-decision of action task in order to test whether adolescents with ASD can exploit task-irrelevant emotional displays to select their subsequent course of action. To date 20 ASD and 18 TD adolescents have been tested and recruitment will be completed in November 2016.
Results:
Preliminary results reveal a trend for choice tendencies (interaction emotion by tendency) similar to adults, in both groups. TD and ASD adolescents avoided anger significantly more than fear but to date only the TD group, and not the ASD, approached fear significantly more than anger. Complementary analyses on movement kinematics and pupil dilation will be performed.
Conclusions:
Preliminary results suggest that while ASD adolescents appear to be able to exploit anger cues to adapt their behaviour (avoidance - defence behaviour system), they may not perceive fearful expression as an affiliative cue leading to approach behaviour.

241 **165.241** Do You See What I See? the Recognition of Bullying in Male Adolescents with Autism Spectrum Disorder

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Background: Youth with ASD have repeatedly been found to be victimized by their peers at a higher rate than typically-developing youth, but few studies have investigated whether youth with ASD are able to recognize and describe bullying situations. The few studies that have focused on these youth's ability to recognize bullying have merely asked the youth whether or not an instance of bullying had occured in the scenario.
Objectives: The current study was designed to investigate not only whether adolescents with ASD were able to recognize bullying when it occured, but also whether they were able to accurately describe the situation, identify the bully/bullies and victim(s), and discuss why the bullying occurred.
Methods: Male adolescents with ASD and typically-developing (TD) controls (M_{age} = 14.62, *SD* = 1.91), matched on full-scale IQ, watched six videos portraying various bullying scenarios and were interviewed after each video. The interviews were coded for the participants' ability to accurately describe the bullying situations.Â We also collected information about the adolescents' own experiences with victimization using self-report questionnaires.
Results: Â Results indicated that adolescents with ASD had significantly lower bullying perception scores compared to TD adolescents *F*(1, 65)= 11.86, *p*= .001, eta squared =.15. Self-report measures of victimization were significantly correlated with bullying perception scores in TD adolescents (*r*(36)= .34, *p*= .034)Â but not in adolescents with ASD *r*(25)= .02, *p*= .917.
Conclusions: Despite receiving a definition of what bullying entails at the beginning of the study, male adolescents with ASD were less able to identify bullying and less able to describe what was occuring in bullying videos than their age- and IQ-matched peers.Â The fact that understanding of bullying was related to experiences with victimization in TD youth but not in youth with ASD raises questions about how youth with ASD understand when they themselves are being bullied. Future research to explore this question will be discussed.

242 **165.242** Does Hot Executive Function Predict Theory of Mind in Children with Autism Spectrum Disorder?

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Background: Previous research has clearly demonstrated that Autism Spectrum Disorder (ASD) involves deficits in multiple neuropsychological functions, such as executive functioning and theory of mind. A conceptual distinction is commonly made between cool (cognitive) and hot (affective) Executive Function (EF). In ASD, continued attention has been paid to the cool areas of executive dysfunction. Cool EF has been strongly related to Theory of Mind (ToM) but research has not taken into account the association between hot EF and ToM in ASD.
Objectives: The current study aimed to investigate group differences in hot and cool EF in school-aged children with ASD relative to typically developing peers by employing a more extensive battery of both cool and hot EF tasks in comparison to previous studies. The second aim was to explore the association between hot and cool EF and ToM abilities in school-aged children with ASD. Traditionally, research on the EF-ToM relationship has mainly employed cool EF tasks. The distinction between cool and hot EF proposes that ToM may be more strongly related to hot EF than cool EF. We thus attempted to specifically examine whether ToM performance could be predicted by hot EF performance after controlling for potential co-variates and cool EF.
Methods: Sixty children with an official diagnosis of ASD (55 males) (M=9.98 years, SD=1.9) and sixty nine (69) controls (M=9.64 years, SD=1.58) (60 males) aged 7-12 years old matched for mental and chronological age completed tasks tapping cool EF (i.e. working memory, inhibition, planning), hot EF (i.e. affective decision making, delay discounting), and ToM (i.e. emotion understanding and false/no false belief).
Results: Significant group differences in each EF measure supported a global executive dysfunction in ASD. Correlational analysis showed several significant associations between EF and ToM measures. Specifically, ToM false/no false belief performance was significantly correlated to Go/No-Go and Tower of London scores, whereas performance on the Eyes Test was related to all EF measures, both cool and hot. Regression analysis revealed that the ASD group demonstrated deficits in emotional understanding relative to controls that were predicted by hot EF delay discounting, over and above cool EF and control variables.
Conclusions: Our findings replicated the well-established relationship between cool EF and ToM but also demonstrated a predictive relationship between hot EF and ToM emotion understanding, prompting questions of how these seemingly distinct constructs are related. This study improves understanding of the profile of higher-order cognitive deficits in children with ASD, which may inform diagnosis and intervention.

243 **165.243** Does Preferential Looking at Social and Non-Social Aspects of Naturalistic Scenes Differ Between Individuals with ASD with and without Intellectual Disabilities?

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Background: Â The social motivation theory of autism spectrum disorders (Klin et al., 2002; Chevallier et al., 2012) suggests that core social-communicative deficits may stem from diminished social motivation. One indicator of social motivation deficits is reduced spontaneous attention to faces (notably eyes), people and social actions (Falck-Ytter & von Hofsten, 2010). While abnormalities have been reported across the life span, most studies were conducted with ASD participants with IQ in the normal range. Although IQ is considered the best predictor of outcome (Howlin et al., 2004) little is known about the effect of IQ on social attention, or whether preferential looking patterns differ between individuals with ASD with and without intellectual disabilities.
Objectives: Â The present study aimed to 1) examine group differences in looking patterns on social and non-social aspects of naturalistic social scenes, 2) to explore the role of IQ/intellectual disability (ID) in viewing patterns, and 3) the relationship between looking patterns and level of social impairments/adaptive functioning in individuals with high-functioning ASD and those with ASD+ID.
Methods: 231 individuals with ASD and 186 controls with typical development (TD) or mild intellectual disabilities (IQ 40-148), aged 12-30 years were recruited as part of the multi-center EU-AIMS Longitudinal European Autism Project. In all centers, gaze patterns during viewing of six static images were recorded via using Tobii eye-trackers. Areas of interest (AOIs) were defined as face, eyes, mouth, and objects that were relevant (i.e., part of a social interaction). Preliminary analyses focused on % gaze time. IQ was measured with the Wechsler scales, social-communicative impairments using the Social Responsiveness Scales (SRS-2) and social adaptive behaviour using the social-subdomain of the Vineland scales (VABSsoc). Individuals were divided into intellectual ability groups (i.e. above and below IQ 70).
Results: We found a significant main effect of IQ group on % gaze time on faces ($p < .001$) as well as an IQ group x diagnosis interaction ($p = .017$). Whereas those with mild ID (without ASD) looked on average less at faces than the TD group ($p < .001$), among the ASD group, intellectual ability level did not affect looking times on faces. In line with previous findings, among individuals with IQ >70, the TD group showed looked longer at faces than the ASD group ($p < .001$; see Fig.1 for an example of viewing times by group during a highly social scene). In the ASD+ID group, higher % gaze time to eyes was significantly correlated with higher symptom severity (SRS-2 scores) ($n = 46$, $r = .41$, $p = .007$). Figure 2 shows the percentage for composite looking times (i.e. all 6 images) for each AOI by group.
Conclusions: Individuals with ASD with/without ID showed similar rates of social attention to faces, while IQ affected viewing patterns in the ID group. This finding is inconsistent with the notion that social motivation may be less influenced by cognitive development in ASD. However, unexpectedly looking times to social features were not linked to level of social impairment/adaptive behaviour. We plan to further investigate fixation patterns (e.g., first looks, average fixation times) in static and dynamic social scenes.

244 **165.244** Dynamic Eyetracking As a Measure of Treatment Response for an ASD Social Skills Intervention

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Background: The development and evaluation of novel ASD treatments currently relies on clinical observations and parent-report questionnaires to examine response to treatment. However, most commonly used measures of ASD symptoms lack sensitivity to change. Therefore, unbiased ASD treatment outcome measures are urgently needed to accurately evaluate novel ASD interventions. Eyetracking-based measures of social attention have the potential to be a reliable measure of response to ASD treatments that target social communication and social cognition skills.
Objectives: This preliminary study aimed to examine the extent to which time spent looking at faces in a dynamic social eyetracking paradigm reflected treatment-related changes in social communication skills due to a social skills intervention for adolescents and young adults with ASD. Changes in clinical report measures of social communication were also evaluated across time points.
Methods: Fourteen adolescents and young adults with ASD (Age: M=16.28 years, SD=2.19) completed a dynamic eyetracking task prior to and immediately following Social Cognitive and Interaction Training for Autism (SCIT-A; Turner-Brown et al., 2008) an 8-week social skills group intervention. Data were collected using a Tobii TX300, which sampled at 300Hz. Participants viewed a silent 8-minute video eyetracking paradigm, which showed children participating in both joint and parallel play (Chevallier et al., 2015). Stimuli include 22 semi-naturalistic, 15-second silent video clips, in which two school-age siblings play together (joint condition) or independently (parallel condition). Tobii software produced a Total Fixation Duration (TFD) outcome measure, which represents the summed length of all fixations within each area-of-interest (AOI). This TFD measure for faces was used as an index of the degree to which participants prioritized faces in joint conditions relative to parallel conditions. The Social Responsiveness Scale, Second Edition (SRS-2) was also collected before and after the intervention.
Results: Paired t-tests were used to examine the change in visual preference for social stimuli and SRS-2 scores before and after the social skills intervention. Results from the eyetracking task showed an increase in visual prioritization of social stimuli following the intervention, t=2.09, p=0.057. This change in visual preference reflects a large effect size, d=0.82. Additionally, SRS-2 scores declined significantly following the social skills intervention, t=6.46, p=<.0001, reflecting a large effect size, d=2.53.
Conclusions: Eyetracking and SRS-2 measures of social communication showed improvement in visual social preference and social communication skills, respectively, in adolescents and young adults with ASD following an 8-week social skills group intervention. These preliminary results suggest that this eyetracking-based measure of social attention may be sensitive to change in the context of an ASD intervention. Further research is needed to examine the reliability and generalizability of these findings to other interventions with appropriate controls for practice effects.

245 **165.245** Dynamic Facial Information Processing in Autism Spectrum Disorders and Typical Development: Social Attention Paradigms

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Background: Autism Spectrum Disorders (ASD) are characterized by atypical patterns of behaviors and impairments in social communication possibly related to an alteration of face processing. Faces bring many social information through their configuration but also through head and facial muscles movements. Human faces have varying degrees of animation: 1/ Micromovements (with only postural adjustments of the head and tone facial muscles); 2/ Macromovements (with facial expressions and eye and head movements).
Objectives: The aims of this study was to characterize, thanks to eye behavioral indices (gaze focus), and eye physiological indices (pupil diameter), responses to facial micromovements and to facial macromovements in typical development and in ASD development.
Methods: Gaze focus (gaze patterns on whole faces and eyes and mouth region, scan time, fixation duration) and pupil responses were recorded with an eye tracking system in 100 typical and 90 ASD children (3-12 years old) during 3 paradigm: *i/ Micromovement paradigm*: presentation of statics and dynamics neutral faces; *ii/ Emotional macromovement paradigm*: presentation of dynamics neutral and emotional faces (happy and sad faces); *iii/ Socio-attentional macromovement paradigm*: presentation of dynamics faces orienting their gaze towards an object.
Results: In both groups, micromovements and emotional macromovements enhance gaze focus in response to faces, but the gaze focus is decreased in ASD group compared to control. Concerning pupil responses, micromovements and emotional macromovements enhance pupil dilation in response to faces only in control group. Socio-attentional macromovements induce gaze orientation towards the object congruent with the gaze of the face presented mainly in control group. Maturation of gaze focus and pupil response was found in both group.
Conclusions: These results underlie atypical processing of emotional and social facial motion perception which could in turn result in impaired social interaction in autistic pathology.

246 **165.246** Effect of ASD Traits on Young Adults' Romantic Relationship Experience

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Background:
While Autism Spectrum Disorder (ASD) is characterized by social communication deficits and challenges in forming close relationships (American Psychiatric Association, 2013), little is known empirically about how these features manifest in adult romantic relationships. Prior literature that explored sexual well-being among adults with ASD has suggested that adults with ASD tend to have less sexual experience and lower sexual satisfaction (Byer & Nichols, 2014; Dewinter et al., 2016). However, no study to date has assessed the effect of ASD traits on other aspects of romantic experience (e.g., breakup) that can lead to negative emotional consequences. This effect may be subject to potential gender differences, given their importance in romantic relationship functioning (for a review, see Miller, 2014).
Objectives:
This study explored whether ASD traits are associated with less and poorer romantic experience among college students, and whether gender moderates these associations.
Methods:
One hundred and ninety-eight typically-developing adults (138 females, 59 males, 1 other) completed the Autism Quotient (AQ; Baron-Cohen et al., 2001) and Romantic Experience Questionnaire (Greene, 2006). Additional questions regarding romantic experience included the total number of romantic relationships and the length of the longest romantic relationship (LRR, if applicable).
Results:
Higher AQ scores predicted fewer total number of romantic relationships (b=-.031, p<.01), and no gender difference was found (p > .29). AQ did not predict LRR, but gender moderated the association between AQ and LRR ($b_{gender*AQ}$=-.029, p =.05), such that the association between AQ and LRR was positive in men but absent in women. Among the participants with prior romantic relationship experience, AQ did not predict any negative romantic experiences (e.g., breakup, being cheated on, etc.) across both genders after controlling for lifetime number of relationships (p > .29). However, gender moderated the relationship between AQ and number of times being left by a partner for someone else ($b_{gender*AQ}$=-.036, p<.05), such that the association between AQ and the number of times being left by a partner for someone else was positive in men but absent in women.
Conclusions:
Adults with greater ASD traits tended to report less romantic experience in general, suggesting that ASD traits may prevent individuals from engaging in romantic relationships. Stronger associations between AQ and LRR as well as the number of times being left by a partner in men than in women suggest a gendered effect of ASD traits on romantic competence. Specifically, the association between ASD traits and LRR may reflect low romantic competence (e.g. an unwillingness to end a relationship due to the difficulty of forming one to begin with, and/or inability to end a relationship). Similarly, an association between ASD traits and the number of times being left by a partner may be a result of subjective distortions of breakup experiences or deficits in romantic relationship functioning. Given the invariance of romantic competence across gender among typically-developing emerging adults (Davila et al., in press), the gendered effect of ASD traits in our findings may result from different manifestations of ASD traits in romantic relationship functioning across genders.

247 **165.247** Engagement Across School Contexts: How Children Interact with Peers on the Playground and in the Classroom

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Background: Children with autism spectrum disorder (ASD) have difficulty in social communication functioning that often negatively impacts their social functioning, especially at school. Children with ASD are often unengaged on the playground and report fewer friends than typically developing peers (Bauminger and Kasari, 2000). On the playground, children with ASD spend about one third of their recess periods unengaged or isolated from peers (Kasari et al., 2011), which can negatively impact their social experience at school. Although previous studies have looked at engagement of children with ASD on the playground, it is uncertain if this level of engagement translates to engagement inside the classroom.
Objectives: The present study sought to explore the social engagement states of elementary school-aged children with ASD during recess play times and during classroom small group activities.
Methods: The data were drawn from a larger pilot study that sought to understand an adaptive playground intervention for children with ASD. Participants included 26 children with ASD (80.6% male) aged 5-12 years who were ethnically diverse (51.6% Hispanic or Latino) and from eight different elementary schools from a large urban school district in the USA. Children were included in general education classrooms for a portion of their day and fell within the typical range of intellectual functioning (≥ 70). Each child's playground engagement with peers was rated by a reliable observer blinded to treatment condition using the Playground Observation of Peer Engagement (POPE; Kasari, Rotheram-Fuller, & Locke, 2005), a measure of children's peer engagement during a ten-minute period. Children's peer engagement was also observed in the classroom during a small group activity and coded using the same interval engagement coding system as the POPE. Both measures categorize the child's behavior into four engagement states: solitary, parallel, parallel aware, and jointly engaged or in games with rules.
Results: Â Descriptive statistics were analyzed to explore the engagement states of children with ASD across playground and classroom observations. Within the classroom, children were solitary 10.5%, parallel 52%, parallel aware 33.3%, and jointly engaged 4.2% of the time. Fifteen classroom observations occurred during small group activities, usually arts and crafts and math, in which the children were mostly parallel aware. On the playground, children spent 30% of their time solitary, 18.2% parallel, 25.3% parallel aware, and 26.5% jointly engaged with peers. Qualitative notes from the POPEs detailed that jointly engagement with peers occurred during structured games with rules, usually facilitated by a paraprofessional aide.
Conclusions: Results highlight that the engagement level with peers vary across school contexts for children with ASD. Although studies have measured social skills engagement within the classroom (Sparapani et al., 2015) and on the playground (Kretzmann et al., 2015), it is important to consider engagement across both settings since they both offer critical information about the child's social functioning. Results may inform school-based social skills treatment interventions.

248 **165.248** Experimental Risk-Taking in Teens with an Autism Spectrum Disorder.

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Background: Puberty is the hallmark of increased real-life risk-taking in typically developing (TD) teens. As teens with an autism spectrum disorder (ASD) develop non-typically, they might take fewer risks than their TD peers. One study investigated risk-taking in teens with and without ASD with an adjusted version of the Balloon Analogue Risk Task for youth (BART-Y; South, Dana, White, & Crowley, 2011), and found no group differences. This study needs replication with the original BART-Y.
Objectives: We will examine whether ASD teens show less risk-taking than TD teens on the BART-Y. In line with South et al.(2011), we will explore IQ and anxiety as predictors of experimental risk-taking. Additionally, we will include pubertal stage as a predictor, and explore whether parent-reported real-life risk-taking is positively associated with BART-Y performance.
Methods: 34 teens with a clinical DSM-IV-TR/DSM-5 ASD diagnosis and 34 age- and gender-matched TD teens (age:12-16, IQ>80) performed the BART-Y. They were assessed on ASD symptoms (SRS [and 3Di diagnostic interview for ASD group]), IQ (WISC-III-NL Block Design and Vocabulary), anxiety (SCARED-71, parent-report), pubertal stage (PDS, self-report), and risk-taking (CAMEL, parent-report).
Results: Groups did not differ on age, gender, and IQ. As intended, ASD teens had higher SRS scores than TD teens (p<.0001). Group significantly predicted BART-Y performance (ASD<TD;β=-5.54,p=.04) and explained 6.1% of its variance. However, Bayesian regression indicated only anecdotal evidence for the hypothesis that groups differed on the BART-Y, BF_{01}=1.47. All other predictors were non-significant. None of their Bayes factors showed substantial evidence for the hypothesis that these factors predicted BART-Y performance. Real-life risk-taking was higher in ASD as compared to TD teens (p=.008, BF_{01}=5.1). BART-Y performance did hardly correlate with CAMEL scores (r=.089. p=.473).
Conclusions: Although preliminary analyses indicated less risk-taking in ASD as compared to TD teens, Bayesian statistics showed that evidence for this group difference was only anecdotal. It is, therefore, more valid to conclude that teens with ASD do not differ from TD teens in experimental risk-taking, in line with South et al.(2011). IQ, anxiety, as well as pubertal stage did not impact experimental risk-taking. Surprisingly, parents reported that ASD teens take more risks in real-life than their TD peers. The next step is to determine whether this is also supported by self-report. Understanding the origin of the contrast between subjective and objective measures of risk-taking during puberty is important to fully grasp risk-taking in ASD teens in this crucial developmental stage.

249 **165.249** Exploring Self-Conscious Emotion Processing in Adolescents with High Functioning Autism

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Background: Autism is commonly associated with atypical emotion processing and perspective-taking abilities. These atypicalities can impose challenges in inferring and appropriately responding to others' thoughts/feelings, which can negatively impact social interactions. While most autism research has explored basic, nonsocial emotion-processing in young children, little is known about advanced, social emotion processing in older youths.
Objectives: Using dynamic, more ecologically valid and salient stimuli, we investigated self-conscious emotion processing in adolescents with high functioning autism (ASD) and neurotypical peers (NT). Specifically, we explored adolescents' ability to infer their peers' level of embarrassment and pride, while manipulating perspective-taking demands.
Methods: Adolescent males ages 11-17 (21 ASD, 11 NT; recruitment ongoing) completed a novel, self-conscious emotion task, consisting of videos of peers singing in a competition. The task included 24 videos representing two factors: emotion (embarrassment, pride) and perspective-taking demands (low, high). In videos requiring low perspective-taking, singers' emotions were congruent with their performance (sing poorly, look embarrassed; sing well, look proud); in videos requiring high perspective-taking, they were incongruent (sing poorly, look proud; sing well, look embarrassed). Participants used a 4-point Likert scale (0=none to 3=high) to rate how intensely singers felt embarrassed and proud. To investigate the fixed effects of group, emotion, and perspective-taking demands on inferred emotion ratings, we ran multilevel modeling in R.
Results: First, we ran a model with emotion, perspective-taking demands, and their interaction as fixed effects. There was a significant effect of perspective-taking demands [$t(733)=-3.89$, $p<0.001$] such that participants gave higher ratings during videos requiring low perspective-taking, and a significant interaction effect of emotion x perspective-taking demands [$t(733)=-3.89$, $p<0.001$]. Second, we ran the same model and included group as a fixed effect. There was no significant effect of group nor its interaction. Furthermore, adding the fixed effect of group did not significantly improve model fit (Model 1: AIC=1424.4, BIC=1452.2; -2 log Likelihood=-706.18; Model 2: AIC=1424.7, BIC=1471.2; -2 log Likelihood=-702.36; χ^2 (4)=7.647, *ns*).
Conclusions: Collapsed across groups, adolescents report lower emotion intensity ratings during conditions requiring higher perspective-taking, suggesting that they perceive their peers as feeling less embarrassed and proud when their performance is incongruent with their emotions. Interestingly, adolescents with ASD make similar inferences about their peers' emotions as NT adolescents. Furthermore, heightened perspective-taking demands similarly reduce the intensity ratings of adolescents with and without ASD. These findings suggest that adolescents with ASD may be able to accurately infer others' emotions, especially in the context of multiple facial/postural cues using more salient and ecologically-valid stimuli. These findings contrast with previous reports of impaired emotion processing in younger children, which may reflect developmental differences or differences in paradigm design. Broadly, these findings suggest that adolescents with high functioning ASD may have relatively intact emotion recognition abilities, but impairments in real world social interactions may be driven by difficulties in applying this information and/or responding in socially appropriate ways.

250 **165.250** Exploring the Effect of Social Anxiety on Eye Gaze in Adolescents with ASD Across Emotion Recognition Paradigms

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Background: Social anxiety is highly prevalent among adolescents with autism spectrum disorder (ASD) and research suggests that anxiety symptoms might heighten the social impairment often seen in this population. Although not entirely consistent, the extant research generally shows a pattern of diminished gaze to social features in the context of heightened gaze to non-social stimuli in people with ASD, relative to controls. Very little research has considered the potential influence of co-occurring social anxiety, diagnostically or dimensionally, on gaze patterns in youth with ASD. Understanding the possible influence of social anxiety on gaze, and other indicators of social cognition, is important given that social anxiety – like ASD, has been robustly associated with atypical social gaze.
Objectives: The goal of the current study is to explore the role of social anxiety on gaze patterns across two separate samples of adolescents with ASD. Additionally, we explore the influence of stimulus type (static, dynamic) and task instructions (free viewing, directed emotion recognition).
Methods: Participants with ASD (n = 28) and age-matched typically developing (TD) adolescents (n = 32) were drawn from two separate studies and included adolescents aged 12 and 17 years, inclusive. In both studies (emotion recognition and free viewing), participants completed one session in which they completed a computerized task where they viewed a single face expressing an emotion and completed a measure of social anxiety: Screen for Child Anxiety Related Disorders (SCARED; Birmaher et al., 1997) or Social Worries Questionnaire (SWQ; Spence, 1995). The Social Responsiveness Scale (Constantino, 2012) was also gathered for all participants. In the emotion recognition study, participants viewed a video of an adult expressing an emotion. In the free viewing study, participants viewed static stimuli of emotions from the NimStim Set of Facial Expressions.
Results: Internal consistency was high for both SCARED (α = .922) and SWQ (α = .816). For the participants with ASD, partial correlation indicated that accounting for ASD severity, self-reported social anxiety symptoms were negatively associated with gaze duration to eye region of the face across presented emotion type (r = -.474, p = .043). This effect was found for stimuli depicting anger (r = -.458, p = .050), surprise (r = -.507, p = .032), and disgust (r = -.533, p = .025). However, this effect was only found for the free viewing paradigm. For the emotion recognition study, self-reported social anxiety symptoms were positively associated with gaze duration to eye region only for the stimuli depicting sadness (r = .656, p = .039).
Conclusions: Results support prior research suggesting that co-occurring social anxiety influences social gaze in youth with ASD. However, this study promotes further examination of the influence of methodological factors (specifically stimulus type and task instruction) on the role of social anxiety on how individuals with ASD view facial emotion stimuli. We will further explore these factors and their likely influence, as well as the relationships among ASD features, social anxiety, and other gaze metrics within both TD and ASD samples.

251 **165.251** Eye Gaze Characteristics of Adults on the Autism Spectrum during Complex Dynamic Facial Emotion Recognition

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Background: Impairment in facial emotion recognition (FER) is regularly associated with Autism Spectrum Disorders (ASD), and possibly underlies aspects of the social communicative difficulties of ASD. Research has sought to examine the contributing mechanisms of this FER difficulty through eye tracking. However, to date, much of the existing literature examining eye gaze during FER has focused on examining the processing of static images of basic emotions (happy, sad, anger, fear, disgust, and surprise). Such stimuli may be inadequate in providing an accurate representation of the extent of FER deficits in ASD. It is arguable that individuals with ASD (particularly higher functioning individuals or adults) have greater difficulty in understanding complex nuanced emotions during social interaction. As such, the investigation of FER of complex emotion may have greater direct practical relevance to the difficulties experienced by people with ASD. To date, no study has examined the eye gaze patterns of adults with ASD during FER of complex, dynamic stimuli. The investigation of eye gaze during the FER of complex, dynamic stimuli may provide more extensive insights in to the cognitive processes underlying FER in ASD.
Objectives: To examine the eye gaze characteristics of adults with high functioning ASD while viewing complex, dynamic facial emotions to investigate the underlying attentional and cognitive processes underlying complex FER in ASD.
Methods: Eye tracking data was recorded while 20 adults with high functioning ASD and 20 IQ and gender matched typically developing adults completed a labelling FER task. Participants were required to complete subset of the Cambridge Mind Reading Face-Voice battery, a battery which consists of videos of complex emotions.
Results: Adults with ASD were significantly less accurate at identifying positive complex emotions (vibrant, empathic, exonerated, and intimate) compared to typically developing counterparts. Adults with ASD also fixated longer to the mouths of complex, dynamic emotions regardless of emotional valence.
Conclusions: Findings suggest that the processing of positive affect is particularly impaired in ASD when viewing complex, dynamic stimuli. Excessive focus to the mouths of complex emotions during FER may hinder the extraction of pertinent information from other core face regions, which may cause particularly pronounced deficits when viewing positively valanced emotions. The findings provide useful insights into the mechanisms of emotion recognition impairments in ASD during the processing of complex social information.

252 **165.252** Eye Gaze and Pupillary Response in Angelman Syndrome

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Background:
Angelman syndrome (AS) is a rare neurological disorder characterized by severe developmental disability, communication impairment, elevated seizure risk, and motor system abnormalities caused by disruption of maternally inherited E3 ubiquitin protein ligase gene (UBE3A) located in chromosome region 15 (15q11-q13) (Kishino, Lalande et al. 1997, Clayton-Smith and Laan 2003). Eye tracking measures, such as the evaluation of gaze points and pupil size, provide promising strategies to quantify the severity of symptoms and resolve subgroup heterogeneity across developmental disabilities (Sweeney, Takarae et al. 2004, Boraston and Blakemore 2007). Several eye tracking studies have reported that individual preference for geometric patterns over social scenes can predict diagnosis of ASD (Pierce, Conant et al. 2011, Gaietto 2014).
Objectives:
The aims of this study were to both determine the feasibility of social scene eye tracking and pupillometry measures in individuals with AS and to compare the performance of AS participants to individuals with idiopathic Autism Spectrum Disorder (ASD) and typically developing controls (TDC).
Methods:
Individuals with AS and age- and gender- matched controls completed a social eye tracking paradigm. Neurobehavioral characterization of AS participants was completed via a battery of psychological testing and caregiver behavioral evaluations such as the Bayley Scales of Infant and Toddler Development (BSID-III) (Bayley and Reuner 2006), Aberrant Behavior Checklist (ABC), Social Responsiveness Scale (SRS), and Vineland Adaptive Behavior Scales (VABS-II) (Sparrow, Balla et al. 1984).
Results:
Forty-seven percent of recruited AS participants completed the eye tracking paradigm.
Compared to TDC, AS subjects demonstrated significantly less preference for social scenes than geometric shapes. Additionally, AS subjects did not show increased pupil dilation, compared to TDC, when viewing social scenes versus geometric shapes. There was no significant difference found between AS and ASD subjects in either social eye tracking or pupillometry.
Conclusions:
This study is the first to demonstrate the feasibility of successful eye tracking in AS. Individuals with AS demonstrated both a lower preference for social stimuli than TDC. The use of eye tracking and pupillometry may represent an innovative measure for quantifying AS-associated impairments in social salience.
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253 **165.253** Eye- Versus Mouth-Looking Patterns in Emotional Contexts in Children with ASD

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Background: Previous literature reports that toddlers with ASD show increased looking at mouths compared to typically developing (TD) toddlers (Jones, Carr & Klin, 2008). However, other studies have found no between-group differences in eyes/mouth attention, though associations between attention to the mouth and language skills have been noted (Guillon, Hadjikhani, Baduel & Roge, 2014). Additional work suggests an important role of context, e.g. Hutchings & Brien (2016) report that children with ASD look more at the mouth when discussing feelings but not actions, with higher mouth gazing associated with poorer verbal ability. The evidence remains unclear as to whether eye- versus mouth-looking patterns can be differentiated between children with and without ASD, and whether the discrepancies are generally moderated by emotional context.
Objectives: To examine looking at the eye versus mouth in children with ASD versus non-ASD during a social-information-seeking task depicting escalating emotional expression.
Methods: Thirty-six 4 to 8 year-olds, ASD n = 14 (MDQ= 88, SD = 20) and non-ASD n = 22 (MDQ= 109, SD=12), watched a video of an actress involved in a stressful activity (e.g. blowing up a balloon until it pops) that ends in a Resolution (e.g. actress sighs in relief after balloon pops). Previous eye tracking analyses had shown that children with ASD spent significantly less time looking at the face (Face%) during the Resolution than non-ASD children ($p < .05$) (Foster et al., unpublished). We examined the components of %Face to examine between-group differences in eye- and mouth-looking (%Eyes and %Mouth) within this escalating emotional context.
Results: Immediately prior to the Resolution, there was no difference in face, eye or mouth gaze allocations between ASD and non-ASD children (see Figure 1). During the Resolution, there was a main effect of diagnosis on %Mouth ($F(1,36)$, $p < .05$, $\eta p2 = .157$) with children with ASD spending less time on the mouth ($M = .76$, $SD = .42$) than non-ASD children ($M = .13$, $SD = .06$). No diagnosis effect on %Eyes was observed between non-ASD and ASD (Ms = .22 and .17, SDs = .03 and .03, respectively). Across all participants, there was a positive correlation between %Mouth and DAS-II Verbal Reasoning Standard Scores ($r = .381$, $p < .05$).
Conclusions: Children with ASD spend less time viewing the face than do non-ASD children in Emotional Contexts but the difference is driven by lower mouth- as opposed to eye-scanning. Given that the Resolution sets up the expectation of an emotional context, it could be that non-ASD children look to the mouth for additional input during periods of emotional expectation, a tendency that may not be developed in children with ASD. If so, then the results support studies that find mouth gazing to be a functional and adaptive behavior that can supplement other communicative visual cues, especially in situations that warrant context deduction (i.e. how is the actress feeling now). However, the correlation between %Mouth and verbal scores suggests an alternative interpretation which links insensitivity to cues during Resolution to communicative competence rather than social disability, specifically.

254 **165.254** Face Engagement in Preschoolers As It Relates to Characteristics of the Broader Autism Phenotype

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Background:
A large body of work has examined visual attention to social images in individuals with ASD to understand how scanning patterns might reflect autism-specific characteristics (for a review, see Guillon et al., 2014). This work has recently been extended to the study of social attention as it relates to autism-related traits found in the general population, or the 'broader autism phenotype' (BAP). For example, Vabalas and Freeth (2016) found that neurotypical adults with higher BAP scores showed less active visual exploration during social situations.
Objectives:
Few studies have looked at relations between BAP and social attention in typically-developing children, and the present study aims to assess how individual variability in BAP during early childhood could relate to attention to social and non-social images.
Methods:
The current sample consisted of 18 preschool-aged children (M_{age} = 46 months, SD = 9.8 months). Each child was shown eight 12-second trials displaying arrays of five items (face, bird, car, phone, color-matched scrambled face, see Elsabbagh et al., 2013), and looking patterns were recorded with an SMI RED 120Hz eye-tracker. After the eye-tracking task, the child's primary caregiver completed the Social Responsiveness Scale, Second Edition (SRS-2, Constantino & Gruber, 2012), a measure used to assess autism-related characteristics, with higher scores reflecting increased levels of BAP. The present participants had SRS-2 scores in a range not typically associated with ASD (T scores below 60). Eye-tracking measures focused on two aspects of face attention: 1) face engagement (time spent on the face out of time spent on all five items); and 2) face fixation bias (difference between average fixation duration to the face and average fixation duration to the other four items). SRS-2 T scores were calculated for Total score, Restricted Interests and Repetitive Behaviors (RRB) and the Social Communication and Interaction composite (SCI).
Results:
For face engagement, a significant negative association was found with SRS-2 Total scores, $r(16) = -.56$, $p = .016$, and SCI scores, $r(16) = -.56$, $p = .016$ (Figure 1), but not RRB ($p = .25$). This suggests that children with more BAP traits of social and communication difficulties show less attention to faces within the array of items. For face fixation bias, a significant negative association was found with SRS-2 Total scores, $r(16) = -.52$, $p = .026$, and RRB scores, $r(16) = -.58$, $p = .011$ (Figure 2), but not SCI ($p = .08$). This suggests that children with fewer BAP characteristics, especially in the RRB domain, showed longer average fixations to the face as compared to the other items.
Conclusions:
Consistent with past work in adults and older children, the present study found that characteristics of the BAP predicted social attention in preschoolers. Different BAP domains predicted differential aspects of social attention, with increased BAP SCI characteristics relating to a smaller proportion of time on the face, and increased BAP RRB characteristics relating to less fixation-specific face biases. Future work is needed to explore the mechanisms by which these different BAP domains might influence social attention across development.

255 **165.255** From Milliseconds to Months: Long-Term Developmental Change in Moment-By-Moment Attention to Social Stimuli in Infants with ASD

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Background: Attention bridges the gap between the environment and an individual's subjective experience: on a moment-by-moment basis, and throughout development, children devote attention to features of the environment perceived to be most relevant. Existing research suggests that children with autism spectrum disorder (ASD) look less at other's eyes and faces than typically developing (TD) peers. However, little is known about how these looking patterns differ on a moment-by-moment basis, or how these differences emerge or change over time. One way to examine the longitudinal development of these looking patterns is to compare the way that younger infants dynamically scan social scenes to how older infants scan the same content, measuring developmental attunement of time-varying visual salience. By 24 months, TD children are remarkably consistent in fixating on the same social content at the same time. This consistency provides a developmental benchmark against which to compare the results of younger infants with and without ASD.
Objectives: Quantify the developmental attunement of time-varying visual salience between 2 and 24 months in infants with and without ASD.
Methods: From 2-24 months of age, children at low- and high-risk for ASD viewed video scenes of naturalistic social interaction (actresses portraying the role of caregiver and scenes of peer children at play) while eye-tracking data were collected. TD and ASD outcome groups were identified by diagnostic evaluations at 24 and 36 months. Analyses focused on low-risk TD males (n = 79) and males with ASD (n = 24). For both groups, time-varying kernel density estimation was used to quantify moment-by-moment visual scanning to eyes, mouth, face, body, and object regions, quantifying the extent to which younger infants looked at the same social content at the same moments in time.
Results: By 7 months, TD infants time their eye and mouth fixations in a manner that is not significantly different from that of TD 24-month-olds (Figure 1, statistical comparisons by bootstrap 95% confidence intervals). Likewise, by 12 months, TD infants time their face fixations in a manner that is not significantly different from that of 24-month-olds. Similar TD milestones are attained at 18 months for body and object regions. In contrast, ASD infants do not time their fixations in a typical manner for eye, face, or body and object looking at any time in the first 24 months of life. Only fixations on the mouth are timed in a manner similar to TD infants, and this similarity occurs 5-6 months later than is typical.
Conclusions: During the first two years of life, TD infants time their fixations in a manner that is increasingly similar to that of older TD children, reflecting a clear developmental progression in attention to dyadic eye and mouth cues, peer faces, bodies and objects. These moments of visual experience lay the foundation for developmental learning and future social functioning. In contrast, children with ASD deploy their attention differently across timescales short and long, creating a uniquely different experience, one which is likely to have cascading effects on future social and cognitive development.

256 **165.256** Gaze Glasses for Outcome Assessment in ASD

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Background: Successful social interaction skills require the marshaling of visual attention and gaze in a fast and accurate manner. However, fast shifts of visual attention (Townsend, et al., 1996) and accurate shifts of gaze are deficient in individuals with ASD (Miller, et al., 2014). In fact, disordered visual orienting is among the earliest signs of ASD identified in prospective studies of infant siblings (Zwaigenbaum, et al. 2005) and it persists across the lifespan (Miller, et al., 2014). However, gaze timing and accuracy are malleable through intervention (Chukoskie, et al., 2013, 2015). Although we have tools to assess changes in gaze on a computer screen, we lack similar objective and reliable tools that can measure changes in gaze behavior in natural social interactions. We need novel outcome measures that will enable us to test the efficacy of interventions that aim to improve social interaction.
Objectives: We evaluated a novel glasses-based eye-tracking tool for the objective assessment of social interactions with one or more partners.Â We also evaluated a suite of computer vision-based tools for analyzing gaze behavior during these interactions.
Methods: We have tested inexpensive eye-tracking glasses in a structured interaction based on a social game with the research participant and two other players. The analysis suite includes tools for face- and object-recognition in the video that enables the analysis of gaze with respect to facial features and objects, as well as trigger events, such as the onset of a sound or object movement.
Results: Twelve children and adolescents with ASD wore the glasses while engaged in a game and social conversation. The glasses were comfortable, quick to don and doff, and involved minimal calibration time. Using computer vision tools, we identified looks to facial features and other objects in the scene, streamlining analysis of the data, which would otherwise have required labor-intensive "hand coding". Using these tools we were able to quantify the number of looks to particular objects or people, the duration of these looks, and the time it took to initiate a look based on a trigger event.
Conclusions: We recommend this novel glasses-based eye-tracking tool and accompanying software suite as a strong candidate for creating objective outcome assessments of social engagement in ASD at a range of ages.

257 **165.257** Gaze Perception, Superior Temporal Sulcus and Autism: An rTMS Study

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Background: The superior temporal sulcus (STS) is known to be implicated in social perception and social cognition processes, mainly the process of eye gaze information. Previous brain imaging studies have suggested that abnormalities within the STS would be related to social impairments in autism. In a recent study with healthy volunteers, we have shown that it is possible to change gaze pattern by transitory inhibition of the neural activity of the STS using repetitive transcranial magnetic stimulation (rTMS). Indeed, inhibition of the right STS reduced fixations to the eyes of characters during visualization of social movies, as measured with eye-tracking (Saitovitch et al. 2016).
Objectives: In this study in adults with ASD, we investigated changes using eye-tracking changes in gaze perception induced by rTMS stimulation of the right STS.
Methods: Seventeen adults with ASD (mean age = 22.4 ± 2.3) participated in the study. ASD diagnosis was based on DSM IV-R and ADI-R criteria. All subjects underwent a structural MRI for a precise localization of the stimulation target for each individual. Subjects underwent both sham stimulation and excitatory rTMS delivered over the right posterior STS (mean Talairach coordinates: 50 -53 15). The rTMS stimulation was delivered following protocol described by Huang et al., 2005. Stimulation was delivered in 2sec trains every 10sec, a total of 190sec (600 pulses), with an intensity of 90% of the active motor threshold. Fixations to the eyes were measured with a Tobii-120 eye-tracker during passive visualization of social movies at baseline, at 3 time-points (1min, 6min and 12min) after sham and at 3 time-points after TMS (1min, 6min and 12min). Eye-tracking data was processed with Tobii-Studio® software. Individual analysis was performed a posteriori in order to detect individual patterns of response, with a threshold of 12% increase or decrease.
Results: At the group level, no significant results were found in fixations to the eyes after stimulation of the STS. Qualitative analysis of data indicates strong heterogeneity in the response. Therefore, individual analysis of data has allowed to identify three different groups within participants: 3 subjects respond to the stimulation by increasing fixations to the eyes (>12%); 8 participants respond to the stimulation by reducing fixations to the eyes (>12%); 6 participants presented no changes in gaze pattern.
Conclusions: This study shows the feasibility of a TMS protocol in participants with ASD. Preliminary results show that, in line with the heterogeneity of autism itself, response to the TMS varies among individuals. Such heterogeneity could be linked to differences in the lasting effects of the TMS in ASD, as described in previous research (Oberman et al, 2012). A further study will address this issue in the perspective to use TMS as new therapeutic strategy in autism.

258 **165.258** Gender Differences in Adaptive Functioning in High-Functioning Youth with ASD

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Background: Autism spectrum disorder (ASD) is overwhelmingly more prevalent in boys than girls (Lai, Lombardo, & Baron-Cohen, 2014), and thus most research to date has primarily focused on males with ASD. However, several studies suggest that females with ASD may show better social communication skills (Mandy et al., 2012) and better adaptive functioning (Howe et al., 2015) than male counterparts, with age and level of cognitive functioning modulating these differences.
Objectives: The current study aimed to investigate gender differences in the adaptive functioning and clinical presentation of high-functioning youth with ASD. Further, we examined whether the relationship between social skills in the diagnostic setting and parental reports of social functioning in daily life differed between genders.
Methods: We examined adaptive behavior and social skills in a cohort of 75 females and 87 males with ASD, matched by age and IQ (ages 8-17 years, IQ>70). ASD diagnosis was confirmed using the Autism Diagnostic Observation Schedule-Second Edition (ADOS-2; Lord et al., 2012), Autism Diagnostic Interview-Revised (ADI-R; Rutter, LeCouteur, & Lord, 2003), and clinical judgment. Parents completed the Vineland Adaptive Behavior Scales-Second Edition (VABS-II) Survey Interview Form (Sparrow et al., 2005).
Results: Results from independent samples t-tests using domain standard scores on the VABS-II indicated that females with ASD had significantly higher scores on the Communication ($t(159) = 2.037$, $p = .043$) and Daily Living Skills ($t(160) = 2.075$, $p = .04$) domains, but males and females did not differ on the Socialization domain ($t(160) = .073$, $p = .942$). These findings suggest that, while females have stronger language and daily living skills, they experience similar levels of social difficulty as males. On the ADOS-2, Restricted and Repetitive Behavior scores did not differ between males and females ($t(159) = .427$, $p = .670$), but females had significantly lower Social Affect scores ($t(159) = -3.397$, $p = .001$). In males, ADOS-2 Social Affect scores were negatively correlated with VABS-II Socialization standard scores ($r(85) = -.276$, $p = .01$), such that boys who exhibited greater social impairments during the ADOS-2 were also reported to have greater social difficulties in their daily lives (based on the VABS-II) . However, in girls with ASD, these indices of social functioning were not significantly correlated ($r(72) = -.018$, $p = .876$).
Conclusions: While both boys and girls with ASD encounter similar levels of social difficulties in their daily lives as reported by parents, fewer social impairments were detected in girls within the diagnostic setting. Furthermore, parent report was strongly associated with diagnostic assessment of social skills in males, but this relationship was not present in females. Our findings suggest that, while girls might appear to have stronger social skills in the structured context of a diagnostic assessment, they may nevertheless struggle in applying those skills in real world settings. Future research should further explore possible gender differences in how social skills displayed during a one-on-one assessment might relate to overall social functioning.

259 **165.259** Gender Identity in People with Autism

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Background:
Females have traditionally been under-represented in autism research, and recently there has been increased interest in sex differences in autism. A related area of significance is *gender identity*, defined as the label an individual gives their gender, and *gender identification*, defined as social affiliation with members of one's gender group. There is evidence that people with autism are more gender variant compared to typically developing people, and they may therefore have lower gender identification. Further, autism identification (sense of affiliation with others with autism) may be lower in women with autism who are in the minority compared to men with autism. Social identification is frequently associated with psychological well-being, and so differences in autism and gender identification could have implications for mental health outcomes.
Objectives:
This study used well-validated measures which have not yet been applied to the autism population to investigate sex differences in autism identification, gender identity and gender identification, as well as comparisons to controls. A further aim was to investigate the relationship between autism and gender identification and psychological well-being.
Methods:
A total of 539 adults participated, including participants with autism (129 women and 143 men) and typically developing controls (143 women and 114 men).Â Participants reported having been diagnosed with an Autism Spectrum Disorder. Participants completed a survey online that included demographic information and self-report measures of gender identity, gender identification, autism identification and psychological well-being (self-esteem, depression and anxiety measures). Data was analysed using Chi-square, Pearson's correlation and 2x2 MANOVAs (sex by autism).
Results:
People with autism were significantly less likely to be gender congruent (have a gender identity congruent with sex assigned at birth; χ^2=45.98, p<.001), and significantly more likely to be gender dysphoric (have intent to change from their sex assigned at birth; χ^2=12.40, p<.001) than controls. Women with autism had lower gender congruence χ^2=150.24, p<.001 and higher gender dysphoria χ^2=11.85, p=.001 compared to men with autism. As predicted, people with autism had lower gender identification than controls F(1,535)=149.49, p<.001. Contrary to the predicted outcome men and women with autism had equivalent scores in gender and autism identification. People with autism had significantly lower self-esteem F(4,527)=29.34, p<.001 and higher depression F(4,527)=38.77, p<.001 and anxiety F(4,527)=46.20, p<.001 scores compared to controls. Gender identification was positively associated with self-esteem R=.195, p=.001 and negatively associated with depression R=-.311, p<.001 and anxiety R=-.240, p<.001. Autism identification was positively associated with self-esteem R=.174, p<.01.
Conclusions:
People with autism experience differences in their gender identity and gender identification as compared to the typically developing population. Women with autism have more varied gender identities compared to men with autism, although both groups had equivalent levels of gender and autism identification. Poor gender identification is associated with poor mental health outcomes, with females at most risk due to their increased gender variance. However, while autistic participants reported poorer mental health than average, having a positive autism social identity appeared to offer a protective mechanism and is therefore a potential target for intervention.

260 **165.260** Heartfelt Emotion: Heightened Sympathetic Arousal and Reduced Changes in Parasympathetic Arousal during Empathy for Pain in Autism

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Background:
The ability to respond appropriately to social cues depends on autonomic flexibility – the capacity to regulate parasympathetic and sympathetic responses to stimuli. It has been proposed that autonomic dysregulation is a contributing pathway to reduced social reciprocity in autism spectrum disorder (ASD), and that parasympathetic regulation is reduced in ASD. However, most studies have focused on resting state arousal in ASD, and have not measured parasympathetic responses to social stimuli. Furthermore, the interaction between parasympathetic and sympathetic responses to social stimuli remains unexamined in ASD. In the case of empathy, it is thought that autonomic responses may either prime an individual for prosocial behaviour, or lead to feelings of personal distress, which are associated with reduced helping and consolation. Typically, heightened parasympathetic arousal and reduced sympathetic arousal to perceiving others' pain are associated with greater empathic concern, increased prosocial behaviour and decreased distress. This pattern of autonomic arousal may be altered in ASD, impeding capacity for social engagement.
Objectives:
We investigated whether sympathetic and parasympathetic arousal during pain observation is correlated with amount of autism traits, as well as with subjective empathic concern and personal distress.Â
Methods:
Individuals with varying levels of autism traits, as measured on the Autism Diagnostic Observation Schedule 2 and Autism-Spectrum Quotient, participated (N = 96, n_{ASD} = 27; ages 14 – 45). Participants watched two cycles of videos depicting facial pain. The stimuli featured male and female actors initially showing a neutral expression (1-3 s), followed by an expression of pain (3 s). We measured pre-ejection period (PEP) and skin conductance levels, indicators of sympathetic arousal, and respiratory sinus arrhythmia (RSA), a measure of parasympathetic arousal, over a 2-minute baseline period and during the videos. The autonomic measures were correlated with Likert-scale ratings of empathic concern for the actors and personal distress in response to the videos.
Results:
Pain observation elicited co-activation of the sympathetic and parasympathetic nervous systems to the first cycle of pain videos, followed by a synergistic decrease to resting state arousal levels. There was a significant interaction between amount of autism traits and video cycle in RSA, heart rate, and skin conductance: Participants with high amounts of autism traits had heightened sympathetic arousal (SCL) in cycle 1. Parasympathetic arousal (RSA) in cycle 1 was not associated with amount of autism traits. However, individuals with lower autism traits showed greater decreases in parasympathetic arousal from cycle 1 to cycle 2, indicating better regulation of arousal. PEP was not associated with amount of autism traits. Participants reported greater empathic concern than personal distress during pain observation. Empathic concern was not correlated with amount of autism traits.
Conclusions:
The subjective and physiological data suggest that empathic concern for others' distress is not diminished in ASD. However, reduced regulation of autonomic threat responses may contribute to reduced social reciprocity in ASD. The findings highlight the importance of including physiological and cognitive emotion regulation strategies in social interventions.

261 **165.261** Helpful or Harmful? a Scoping Review of Autism Spectrum Disorder Diagnostic Disclosure

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Background: Â People with autism spectrum disorder (ASD) often experience stigma, bullying, and social exclusion, perhaps due to the 'invisibility' and social deficits of ASD (Broady, Stroyle, & Morse, 2015; Chambres, Auxiette, Vansingle, & Gil, 2008; Humphrey & Lewis, 2008; Nowicki & Sandieson, 2002). For these reasons, deciding to disclose a diagnosis of ASD to others represents an important life decision for persons with ASD and their families. Diagnostic disclosure may affect stigma and social inclusion, as well as other aspects of everyday life, yet little is known about diagnostic disclosure for individuals with ASD. Research investigating the positive and/or negative implications of disclosure or non-disclosure can help inform the decision-making processes for people with ASD and/or their families, and benefit professionals to whom parents and people with ASD often turn for advice and support.
Objectives: To identify, describe and summarize existing literature on outcomes and perceptions of disclosure or non-disclosure of an ASD diagnosis to others (e.g., teachers, peers, employers).
Methods: A scoping review of scientific literature using Arksey's and O'Malley's (2005) methodological framework was conducted. Relevant English-language databases (PsycInfo, ERIC, CINAHL, Medline, and SocINDEX) and reference lists were searched using terms related to ASD (e.g., autis*, ASD, pervasive develop* dis*), disclosure (e.g., reveal*, divulge*), and perspective (e.g., attitude*, accept*). Studies that focused on disclosure to the person with ASD and/or his parents were excluded. Search was limited to studies available in English published between 2004 and the present. Thematic analysis was conducted using mind mapping (Davies, 2011) procedures.
Results: Â Twenty-seven articles met the inclusion criteria. These articles focused on outcomes for children (n=9), adolescents (n=5), and adults (n=13) diagnosed with ASD. Perspectives of disclosure from two standpoints were presented: from persons diagnosed with ASD (n=15), and from the perspective of others (n=14) (two articles included both perspectives). Knowing one's diagnosis appeared to alter views of persons with ASD. However, there was disconnect in perspectives between others (e.g., peers, general public without ASD) and persons with ASD. Results suggest that others perceive that diagnostic disclosure has positive effects on social acceptance and perceptions of disability (e.g., decreases negative behavioral attributions) for children and adolescents with ASD, especially when explanatory information about ASD was provided with the ASD label. Existing research also supports an assumption by others that diagnosis should and will be disclosed. Studies on the perspective of persons with ASD (most of whom were adults) indicated that they were generally reluctant to disclose their diagnosis due to perceived stigma. Disclosing their diagnosis was perceived to lead to negative outcomes.
Conclusions: Existing research suggests that disclosing a diagnosis of ASD will positively impact social acceptance by others, at least for children or adolescents with ASD. However, adults with ASD perceive stigma related to an ASD label. Professionals and the general public should be aware of their assumptions related to ASD and diagnostic disclosure. More research on the processes and outcomes of diagnostic disclosure in ASD, across the lifespan, is warranted.

262 **165.262** Hostile Attributions of Intent and Comorbid Behavior Problems in Children with ASD

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Background: The tendency to attribute hostile intent in social situations has been linked robustly to aggressive behavior and poor peer status in children with neurotypical development (e.g., Orobio de Castro et al., 2002). Related research on children with ASD has been limited and characterized predominantly by a focus on group differences. Of the studies that have addressed associations between attributional processes and social and behavioral functioning in this population, findings are decidedly mixed. Some studies have revealed expected relations between greater hostile attributions and poorer outcomes (Meyer et al., 2006) whereas others have not detected significant associations (Flood et al., 2011; Ziv et al., 2014).
Objectives: This pilot study sought to clarify and extend prior research by: 1) further examining the role of hostile attributions of intent in relation to parent-reported social problems and challenging behaviors in children with ASD, and 2) investigating processes in children with more diverse developmental profiles than have typically been included in prior research.
Methods: Participants included families of 21 children (71% male; 48% Caucasian/Non-Hispanic) with ASD between the ages of 5 and 11 years (*M*=8.43, *SD*=1.63). Mean child IQ fell within the low-average range, but significant variation was present (SB-5 ABIQ: *M*=85.19, *SD*=19.83, 43% IQ<76). Children's attributions of hostile intent were coded from the *Home Interview with Child* (CPPRG, 1991). The total number of hostile attributions generated, number of hostile attributions produced for minor harm scenarios, and number of hostile attributions generated for unsuccessful peer entry situations were considered (K=.94). Children's social problems and challenging behaviors were indexed by parent report on the *Child Behavior Checklist* (*T*-scores for Social Problems, Rule-Breaking Behavior, and Aggressive Behavior) and the *Social Skills Improvement System Rating Scales* (scores for Problem Behaviors, Externalizing Behavior, and Bullying).
Results: Child age, gender, IQ, and family income were not significantly related to hostile attributions. Given sample size considerations, emphasis was placed on statistical significance as well as effect sizes. Trends were observed for associations between total number of hostile attributions and parent-reported rule-breaking behavior, *r*=.45, *p*=.06, and aggression, *r*=.43, *p*=.05. Associations with social problems, r=.34, *ns*, and general problem behaviors, *r*=.30, *ns*, were in the same direction and moderate in strength, but non-significant. Hostile attributions generated for unsuccessful peer entry vignettes were more consistently associated with parent-reported outcomes than were attributions for minor harm scenarios. Hostile attributions for peer entry events were significantly positively associated with parent-reported social problems, *r*=.53, *p*<.05, rule-breaking behavior, *r*=.58, *p*<.01, and aggression, *r*=.53, *p*<.05. In contrast, hostile attributions in minor harm scenarios appeared more important for understanding parent-reported bullying behavior. Total number of hostile attributions of intent (B=.52, *p*<.05, OR=1.69) and hostile attributions for minor harm (B=1.05, *p*<.05, OR=2.85) were predictive of increased likelihood of elevated bullying behavior. The more general SSiS Externalizing Behavior score was not significantly associated with attributions.
Conclusions: Hostile attributions of intent may represent an important individual difference factor for children with ASD. Improved understanding of mechanisms underlying comorbid behavior problems may provide valuable insight into avenues for targeted intervention.

263 **165.263** How Adolescents with Autism Spectrum Disorders (ASD) Spontaneously Attend to Real-Life Scenes: Use of a "Change Blindness" Paradigm

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Background: Current behavioral research in Autism Spectrum Disorders (ASD) argues in favor of a dissociation between superior abilities in detecting visual details and deficient visual attention towards relevant social signals. The component of visual attention was assessed through "change blindness", a perceptual occurrence that transpires when a change in a visual stimulus is introduced and the observer does not notice it straightaway.
Objectives: To compare the visual attention of adolescents with and without (ASD) when viewing real-life stimuli by measuring the response times between the time observers were asked to search for a change in a visual stimulus task and the time they detected the change.
Methods: Twenty-eight adolescents with high-functioning ASD aged 12- 18 years and 25 matched TD adolescents viewed 36 pairs of digitized photographs. Each pair was identical apart from a single difference in the presence or absence of a particular item. This item was either a central component of the scene depicted on the photograph or was a marginal detail. The images were displayed in a 'flicker paradigm' whereby the item alternately appeared and disappeared.Â
Results: As expected marginal details were harder to detect than central components of the scenes. However, the pattern of response times did not differ significantly between the two groups of participants.
Conclusions: Adolescents with ASD did not demonstrate different change blindness behavior compared with TD. These results, although supported by previous findings using a similar paradigm, challenge the hypothesis of superior visual detection abilities in ASD and warrant further analysis

264 **165.264** How Do Typically Developing Undergraduate Students Reason about Including Peers with ASD?

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Background: Increasing numbers of students with ASD are entering post-secondary education, but there is little research to support meaningful inclusion in these environments (Newman et al., 2011). This study explores how undergraduate students evaluate and reason about hypothetical scenarios in which a protagonist does not invite a target student to a social event based on the target's disability status. When reasoning about exclusion, individuals often rely on moral justifications, which pertain to welfare, justice, and rights. How different justifications are prioritized influence individual's ultimate evaluations as to whether exclusion is right or wrong. Evaluations and reasoning about social issues can vary by the context in which the social event occurs, and the characteristics of the person being excluded (see Smetana, 2006 for a review).
Objectives: To determine if the probability that:

- Participants' evaluations regarding the permissibility of the protagonist's decision varies according to the social context and the target's disability (ASD vs Learning Disability [LD]).
- Participants' use of moral justifications to explain why failing to include is permissible varies by context and the target's disability.

Methods: One-hundred fifty undergraduate students were administered two versions of three different vignettes in which a protagonist chooses not to invite an individual with a disability (the target) to a social gathering. The target is identified as having ASD in one version of the vignettes, and LD in the second version. The social scenarios in each vignette varied from private (a party in one's dorm) to public (a school cafeteria and admission to a university). Participants were asked to evaluate whether the protagonist's decision is acceptable or unacceptable (evaluation) and indicate their reasoning (justification). Mixed-effects logistic regression was used to account for the nesting of responses within participants.
Results: Preliminary findings from 55 participants indicated that, for participants' evaluations, there was a main effect for disability but not context. Participants were more likely to consider the protagonist's decision acceptable when the target had ASD as compared to LD (OR = 6.28, p= .006). Moral justifications for why failing to include was acceptable were more likely to be given when the character had an ASD as compared to LD (OR = 8.48, p < .001) and in the university as compared to the party context (OR = 3.21, p < .001).Â Finally, there was an interaction between the university context and disability (p= .01). The odds of using moral justifications to indicate why it was permissible not to include a student with a disability at a university was 27.18 if the target had ASD, and 8.67 if the target had LD. In non-university contexts, odds were .85 for ASD and 2.62 for LD.
Conclusions: These findings show that university students find it more acceptable not to include students with ASD as compared to LD, and use moral justifications to support their evaluation. Students may feel that, in certain contexts, including students with ASD may inhibit their well-being. University students may need information regarding the value of including students with ASD in contexts related to university life.

265 **165.265** Humor Responses and Social Referencing in Children with ASD: The Role of Social Cognitive Complexity

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Background: Humor is a universal experience, but some kinds of humor are more complex than others. Slapstick humor and social humor, for example, rely on two different types of cognitive processes and levels of social understanding. Prior research suggests that individuals with ASD may prefer slapstick comedy and simple jokes over humor that hinges on social cognitive inferences about beliefs or feelings (Ricks & Wing, 1975; Samson & Hegenloh, 2009). Additionally, research suggests that audible laughter may be an area of relative social strength for individuals with ASD, as the laughter of children with ASD has been found to be pleasant to naïve raters (Hudenko & Magenheimer, 2011). Given that expressions of positive affect and shared humor experiences can form a foundation for peer friendships, it is important to understand how children with ASD respond to different kinds of humor stimuli.
Objectives: Assess how children with ASD respond to humorous videos that contain different levels of social-cognitive complexity.
Methods: Participants were 43 children (28 male, mean age: 10.46 years; ASD N=20, TDC N=12, non-ASD mixed clinical or first-degree relative with ASD N=11; matched on age and sex ratio). Children watched two short videos that showed: 1) a baby laughing hysterically at a dog chasing bubbles (Figure 1a), and 2) a father giving his baby a lemon wedge to taste for the first time (Figure 1b). Children's responses were coded for the presence or absence of smiling, laughing or giggling, speaking over the video, and social referencing (i.e., looking at the task administrator during the video to share affect or seek nonverbal information).
Results: Â Smiling was the most frequently observed response, with 93% of participants exhibiting at least one smile during the videos. Nearly half of participants engaged in social referencing at least once (49%), while only about 30% laughed out loud or spoke during the video. We examined diagnostic group differences in the two most frequent responses (smiling and social referencing) via repeated measures ANOVA. A three-way interaction emerged between video (Bubbles, Lemon), response (Smiling, Social referencing), and diagnosis [ASD, non-ASD, TDC; F(2,40)=2.97, p=.06; Figure 2]. Planned t-tests revealed that fewer children with ASD smiled during the lemon video than the bubbles video, and more children with ASD engaged in social referencing during the lemon video than the bubbles video (ps<.05).
Conclusions: These preliminary data suggest that when videos depict more social-cognitive complexity, children with ASD smile less and engage in more social referencing. One explanation for this finding is that the lemon video is ambiguous, leading to greater uncertainty in how to respond. Whereas the baby's laughter in the bubbles video provides a clear clue to the video's intent, the lemon video requires perspective-taking; the viewer may smile in response to the father's humorous tone, or sympathize with the baby's disgust. To understand individual response patterns more fully, we will transcribe children's verbal descriptions of the videos. Future studies will identify characteristics of the perceiver that predict humor responses to videos with varying levels of social-cognitive complexity.

266 **165.266** I Think We'Re Alone Now: Solitary Social Behaviors in ASD

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Background: For years, individuals with Autism Spectrum Disorder (ASD) were described as producing uniform, emotionless, and flat facial expressions (Review in Begeer et al., 2008). But recent studies have found facial expressions among individuals with ASD to be more variable and sometimes more intense than those of TD participants (Faso et al., 2015; Grossman et al., 2015).
These mixed findings may be due to the different social settings within which facial expressions are monitored (Rinn, 1984; Namba et al., 2016). We hypothesize that modulation of facial expressions based on social context is impaired in ASD.
Objectives: To investigate spontaneous expressions in a context designed to be relatively free of social demands.
Methods: We presented four minutes of YouTube clips to twenty adolescents with ASD (ages 10 - 17, 3 females) and twenty TD adolescents (ages 10 - 16, 7 females) who were not significantly different on IQ (ASD *M* = 115, TD *M*= 109), age, and gender. We told participants that they should watch these clips to keep themselves entertained while the researchers set up the next study. Researchers remained in the room but were hidden by a partition, so that participants watched the videos without a social partner.
We coded video-recordings of participants watching the YouTube clips for facial responsiveness ("High", "Low", or "None") based on the intensity and variety of facial expressions. We also coded for laughter and vocalizations (e.g., "Gross!", "Eww!").
Results: Â A higher proportion of participants with ASD (55%) were "high responders" than TD participants (5%), $p < 0.001$. Conversely, all "Non-responders" were TD individuals. All participants with ASD laughed at the videos, 50% of TD participants laughed, $p = 0.001$. More participants with ASD vocalized in response to the videos (79% versus 21%), $p = 0.001$.
Conclusions: Â During (pseudo)-solitary video-watching, adolescents with ASD produced a greater variety and intensity of facial and vocal expressions than TD peers. In fact, all "flat" and "emotionless" participants were TD. They may have suppressed their expressions because the RA was still present in the room (Robbins & Vandree, 2009). Also, TD participants may not have amplified their expressions because of the lack of social reciprocity of the situation (Rinn, 1984; Chapman, 1973; Robbins & Vandree, 2009).
The fact that the ASD group was so much more expressive was unexpected. Perhaps, once they were "alone," they felt unencumbered by social pressures, and reacted spontaneously to the videos. But it is also possible that the ASD group interpreted the social context of the experiment differently from their TD peers. Although the RAs couldn't see the videos from behind the partition, participants with ASD may still have considered them social partners and used their exaggerated expressions, comments and laughter as social overtures. This study sheds light on the impact of perceived social context on the facial and vocal expressions of adolescents with ASD.

267 **165.267** Implicit Action Anticipation in Children with and without ASD and Varying Intellectual and Language Impairments: Testing the Application of a Non-Verbal Eye-Tracking Paradigm in a Heterogeneous Sample

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Background: Â
Explicit theory of mind has mostly been measured using verbal false belief paradigms and findings have been complicated by both the verbal nature of the tests and also by the pragmatic and structural language ability of the populations in question. To counteract this, Senju et al., (2010) built on Onishi & Baillargeon's (2005) study of implicit false belief attribution and found that children with ASD (aged 6-8 years; n = 12) had difficulties with action anticipation (AA) compared to their typically developing (TD) counterparts matched on age and fluid intelligence.
Objectives:
The primary aim of the current study was to replicate Senju et al's (2010) experiment with a larger cohort of children with ASD; including both low (**ALI**) and high (**ALN**) verbal abilities as well as those with idiopathic (no known cause) intellectual disabilities (**ID**) in comparison to **TD** children. A secondary objective was to test any associations of AA ability with VIQ and conceptual semantic knowledge.
Methods:
Four groups were recruited in a between measures design: **ALI** (*n*=11;12-18 years; VIQ < 75 on WASI verbal subtests); **ALN** (*n*=15; 6-11 years; VIQ > 90); **ID** (*n*=11; 12-18 years; VIQ < 75; and **TD** (*n*=18; 6-11 years; VIQ > 90). Fluid intelligence (Ravens Coloured Progressive Matrices) and conceptual semantic knowledge (The Pyramids and Palm Trees Test; PPT) were also assessed.
Eye tracking data was collected using the same methodology as Senju et al., (2010) and Southgate et al., (2007). A video was presented of an actor watching a ball being hidden in one of two boxes. The object was then displaced when the actor was looking away.Â Total looking time to the correct versus incorrect location was then coded which represented children's anticipation of the actor's behaviour. This was only possible if children had attributed a false belief. Success at the fourth familiarisation stage was necessary for inclusion. Surprisingly 27 out of a total 55 participants (49%) were excluded (ALI = 5/11; ALN = 9/15; ID = 4/11 & TD = 10/18). Additional tests of false belief attribution included an explicit question from the experimenter at the end of the video and a 'Hidden Contents' standard false belief task (SFB).
Results:
Due to the unexpectedly high participant exclusion rate analyses were conducted on the dataset before and after exclusion to explore the possibility that children may have taken longer than the 4 trials to familiarise. This was not the case. In both analyses there were no significant differences between any of the groups on implicit action anticipation (IAA), nor on the explicit AA question. This was also the case when combined **ASD** (ALI +ALN) versus **Non-ASD** (ID + TD) groups were taken into account. In addition there were no significant associations found between AA and other theory of mind measures (SFB and explicit question), as well as VIQ and PPT.
Conclusions:
These findings call into question the validity and reliability of this experimental paradigm and invite further discussion as to how this may be remedied. Several explanations are offered.

268 **165.268** Implicit Attitudes Towards Individuals with Autism By College Students and the General Population

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Background: Individuals with autism spectrum disorder (ASD) demonstrate strengths and challenges. Thus, it is not surprising that some studies demonstrate that individuals with ASD are perceived negatively, whereas other research suggests positive perceptions (Swaim & Morgan, 2001). Most research has relied on self-report which is effective at evaluating explicit attitudes but is susceptible to social desirability biases. To more completely characterize the attitudes towards members of social groups, it is also important to assess implicit measures because each method predicts different types of behavior. Furthermore, measuring these attitudes in diverse samples of individuals is vital.
Objectives: The goal of these studies was to address gaps in the literature by designing a measure of implicit bias and assessing implicit attitudes towards people with ASD. Study 1 measured implicit attitudes of college students and Study 2 focused on implicit attitudes of the general United States population. In addition, we sought to determine whether individuals who report more autistic behaviors would show less implicit bias towards persons with autism than those who report fewer autistic behaviors.
Methods: Participants in Study 1 were 178 non-ASD college students (65 male; *M* = 19.15 years, 50.0% White). In Study 2, participants were 94 non-ASD individuals (50 male; *M* = 31.3 years, 66.0% White) who were recruited through Amazon MTurk. All participants completed a modified version of the Implicit Attitudes Test (IAT, Nosek et al., 2002) which we developed to assess attitudes towards autistic and neurotypical individuals. The Autism Quotient questionnaire (AQ; Baron-Cohen et al., 2001) measured self-reported autistic traits.
Results: In Study 1, there was an overall implicit bias against individuals with autism (*d* = 0.83, *SD* = 0.41)*;* this mean was significantly different from 0, *t*(177) = 27.09, *p* < .001. These findings demonstrate that participants had more positive implicit associations with neurotypical compared to autistic individuals. The IAT was significantly negatively correlated with the total AQ score, *r* = -.18, *p* = .02, such that individuals who reportedh more autistic behaviors had less implicit bias. The results of Study 2indicated implicit bias against individuals with autism (*d* = 0.63, *SD* = 0.47). This bias score was significantly different from 0*, t*(93) = 12.94, *p* < .001. As in Study 1, there was a significant negative correlation between AQ score and IAT score, *r* = -.45, *p* < .001. Thus, both college students and adults who report more autistic behaviors held less implicit bias toward those with autism.
Conclusions: Â We created the first IAT to measure students' implicit associations with neurotypical and neurodiverse individuals. In both studies, our samples generally held an implicit bias against individuals with autism. In addition, this bias was weaker for individuals who reported higher numbers of autistic behaviors. This latter finding suggests that individuals with autistic traits may be more sympathetic to individuals with autism because they have experience with and understand the behaviors displayed by those with autism.

269 **165.269** Increased Synchronous and Sustained Social Interactions Following a Social Skills Intervention for Adults with ASD

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Background: Despite increases in research examining the efficacy of social skills interventions for individuals with Autism Spectrum Disorder (ASD), few studies have targeted adults. This is problematic as peer relationships during adulthood demand interactions that display complex social behaviors (i.e. behaviors occurring at the same time as each other) for optimal impact and efficiency.
Objectives: This study examined the effectiveness of a social skills intervention for adults with ASD as evidenced by an increase of synchronized behaviors (i.e., eye contact, affect, and verbalization) at post-intervention of the social skills project compared to pre-intervention.
Methods: Twenty-five adults between the ages of 18- and 30-years-old (*M* = 23.47, SD = 4.13) completed a 5-minute unstructured conversation with a same-age peer confederate pre- and post-intervention. The adolescents (84% male, 88% Caucasian) were diagnosed with ASD, confirmed by collateral reports on the Social Responsiveness Scale, Second Edition (SRS 2; *M* = 67.96, SD = 9.22). Additionally, verbal IQ was estimated using the Kaufman Brief Intelligence Scale, Second Edition (KBIT-2; *M* = 99.28, SD = 16.48). The target participants' behaviors were coded using Noldus Information Technology software. The 5-minute dyad conversations were coded for seconds of eye contact and positive affect. Verbal activity was also coded, including the number of questions, validating statements, commenting statements, topic changes, run-on statements, and social niceties.
Results: Â *T*-tests were conducted to compare the participants' use of synchronized behaviors at pre- and post-intervention. The duration of synchronized behaviors increased greatly at post-intervention. Following the intervention, when the participants were verbalizing they displayed an increase in synchronous eye contact (*t* = -3.55, *p* < .01), as well as positive affect (*t* = -3.23, *p* < .01). Additionally, when the participant was verbalizing and displaying positive affect simultaneously, they also displayed a significant increase in eye contact following the intervention (*t* = -4.20, *p* < .001).
Conclusions: Â Presently, there is little research regarding the efficacy of social skills interventions for adults with ASD. Results of the current study show an overall increase in adults' use of complex social behaviors following a social skills intervention. These skills can be an indicator of quality conversations, though the skills often need to be explicitly taught to individuals with ASD to increase social functioning. The study shows preliminary evidence that an intervention targeted specifically to adults is successful in increasing these complex social behaviors.

270 **165.270** Increased Value of Biological Motion in Individuals with Few Autistic Traits

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Background: Individuals with a diagnosis of Autism Spectrum Disorder (ASD) characteristically demonstrate impaired eye-contact during social interactions, and from an early age, look less towards faces than typically developing (TD) individuals. The Social Motivation Theory of Autism posits that this is due to a reduced sensitivity to the reward value of social stimuli, specifically faces, in ASD. Research has also demonstrated that TD individuals preferentially orient towards another type of salient social stimulus, namely biological motion. Individuals with ASD, however, do not show the aforementioned behaviours. Although the reward value of faces to TD and ASD individuals has been investigated, it remains unknown how rewarding both populations find biological motion.
Objectives: The present study investigated the value assigned to biological and non-biological motion by typically developing participants, and further examined whether reward values differed in individuals with more autistic traits. Videos of a human performing smooth, natural movements were used as a proxy for biological motion, and videos of a human performing rigid, robotic movements were used as a proxy for non-biological motion.
Methods: Autistic traits were measured in typically developing adults who then completed an innovative behavioural paradigm that measures stimuli preference.
Results: The results suggest that typically developing participants prefer biological, or human-like, motion, and exert more effort to view this type of stimuli in comparison to non-human-like motion or control stimuli. However, this preference appears to be weaker in individuals with more autistic traits.
Conclusions: This study is the first to investigate the reward value of biological motion in adult participants in the same way as has previously been investigated for faces. These results thus provide novel findings that TD individuals show a preference for biological motion, and that this preference is reduced in individuals with more autistic traits. Furthermore, this study helps us to begin to understand whether individuals with ASD assign a reduced reward value to faces alone, or whether these individuals find a broader conceptualisation of social stimuli less rewarding compared to TD individuals.

271 **165.271** Influence of Parental Emotion Scaffolding on Children's Emotion Regulation, Social Functioning, and Behavior Problems

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Background: The development of emotion regulation remains understudied among children with autism spectrum disorder (ASD). In particular, little inquiry has been made into how parents influence children's emotion regulation development, despite strong evidence for parents' role in this area for typically developing children (Morales et al., 2005; Grolnick, Bridges & Connell, 1996).Â Furthermore, emotion dysregulation is closely related to social difficulties for children with typical development (e.g., Blandon, Calkins, & Keane, 2010; Brophy-Herb et al., 2013; Eisenberg et al., 1993) and children with ASD (e.g., Berkovits et al., 2016), suggesting that strategies that reduce dysregulation might lead to improvements in social functioning.
Objectives: Specific research questions addressed are: To what extent does parental scaffolding of children's emotion understanding predict change in teacher ratings of children's (1) emotion dysregulation, (2) behavioral difficulties, and (3) social skills?
Methods: This study examined emotion dysregulation in 4- to 7-year-old children with ASD (N=59) using data obtained from a multi-site longitudinal study collected at two timepoints, 10 months apart. Children's ASD diagnoses were confirmed using the ADOS-2 and all children exhibited IQ ≥ 50. Parental scaffolding of children's emotion understanding was observed and coded during an 8-minute parent-child shared reading task (with wordless picture books) at the first of two visits. A summary code captured the frequency and depth of parents' emotion-related comments during the task. Children's emotion regulation abilities were measured using teacher report on the Emotion Dysregulation Index of the Teacher Report Form (TRF-EDI; Achenbach & Rescorla, 2000, 2001; Samson et al., 2014) at both timepoints. Teachers also reported on children's internalizing and externalizing behaviors on the TRF and social skills on the SSIS (Gresham & Elliott, 2008) at both timepoints.
Results: Hierarchical regressions showed that higher parental emotion scaffolding predicted improvement in teacher ratings of children's emotion dysregulation across the two timepoints. Parental emotion scaffolding explained an additional 5.9% in variance in later ratings of children's emotion dysregulation, after accounting for prior level of dysregulation (ΔR^2=.059, p<.05). Higher parental emotion scaffolding also predicted significant improvement in teacher ratings of children's internalizing behaviors, explaining an additional 5.7% of the variance in later ratings (ΔR^2=.057, p<.05). Prediction of change in children's externalizing behaviors was marginally significant (ΔR^2=.045, p<.10). Parental emotion scaffolding did not directly predict change in children's social skills across the two timepoints. However, mediation analyses (i.e., utilizing SPSS PROCESS macro with bootstrapping) found a significant indirect effect of parental emotion scaffolding on teacher ratings of social skills, whereby higher emotion scaffolding predicted improvement in child emotion dysregulation which, in turn, predicted improvement in social skills.
Conclusions: Parental emotion scaffolding predicted improvement across time in teacher ratings of child emotion dysregulation and behavior problems and indirectly predicted improvement in child social skills. Of note, this study used teacher measures to validate the influence of parental emotion scaffolding, reducing shared method variance in determining the effects of parenting on child behavior. These findings could inform interventions to teach parents how to support their children's emotion regulation development and social and behavioral functioning.

272 **165.272** Influences of Others' Speech on Gaze Behavior during Activity Monitoring in Children with and without ASD

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Background: Â Monitoring of the activities of others is a crucial component of social learning in young children. Recent work has highlighted that atypical attention patterns in toddlers with autism spectrum disorder (ASD) during activity monitoring may be associated with cognitive deficits and greater autism severity (Shic, Bradshaw, Klin, Scassellati, & Chawarska, 2011; Shic et al., 2014). While toddlers with ASD exhibited looked less towards socially-relevant information and showed insensitivity to others' gaze information, high-functioning adults with ASD appeared to attend to actresses' gaze cues during activity monitoring (Foster et al., 2016). Although others' gaze cues may not be salient to toddlers with ASD, the presence of others' speech may encourage them to direct their attention towards people in the scene (Ahn et al., 2016). As sensitivity to social information in ASD individuals varies across development, it is important to understand the developmental trajectory of sensitivity to others' speech during activity monitoring in ASD.
Objectives: Â To explore the extent to which the presence or absence of others' speech influences attention allocations in children with and without ASD during activity monitoring.
Methods: Â Thirty-eight children aged 4-8 years (ASD n=16, TD n=22) viewed 12 10s video clips of two actresses interacting over a shared task (e.g., cutting toy vegetables). The video clips varied by the actress pair, type of activity, background, gaze behavior of the actresses (mutual towards each other or towards the activity), and presence of distractors (many distractors or no distractors). Eye-tracking methodology was employed to examine participants' gaze patterns. Analyses were conducted to examine between-group differences during the presence and absence of speech in the proportion of time participants spent looking at the actresses' heads (%Head), the area of shared central activity between the two actresses (%Activity), and the background elements including distractors (%Background).
Results: Consistent with previous work with toddlers, school-age children with ASD attended significantly less to the actresses' heads (p<.05, ηp2=.04) and activity (p<.01, ηp2=.07) and looked significantly more at the background elements (p<.01, ηp2=.07) regardless of the presence of speech. Both ASD and TD children exhibited a larger %Head during mutual gaze between the actresses (p<.01, ηp2=.11) and during the presence of speech (p<.05, ηp2=.03), as well as a larger %Activity during activity gaze between the actresses (p<.01, ηp2=.33). They oriented their attention towards the background during the absence of speech (p<.05, ηp2=.03).
Conclusions: These results support previous findings that children with ASD demonstrate diminished attention towards people and activities. Similar to the toddler work, the current results indicate that both ASD and TD school-age children demonstrate sensitivity to others' speech. However, the gaze cues of the speakers seem to be more salient to 4-8 year-old ASD children than to the toddlers, which is a similar pattern exhibited by adults with ASD. Thus, the attention allocation during activity monitoring in individual appear to alter around school-age. Further research should investigate the effects of others' speech on attention patterns in adults with ASD in order to fully understand the development trajectory of attention to social information in ASD population.

273 **165.273** Innovations in Theory of Mind Assessment: The Theory of Mind Inventory-2

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Background: Traditional assessments of Theory of Mind (ToM) utilize direct measures of child performance and are plagued by ceiling effects (when mentalizing is relatively good), test-practice effects, and a child performance factors including language, motivation, attention, and memory. To complicate matters, significant disagreements and confusion in science are arising, not because people hold incommensurable world views, but because of the variable methodology and vague terminology that surround the construct of ToM.
Objectives: Develop two resources that can be used in research and clinical practice. These are 1) the Theory of Mind Inventory (ToMI-2; a reliable and valid caregiver broadband measure of ToM) and 2) the Theory of Mind Atlas (or encyclopedia) which is intended to map the broad and multifaceted construct of ToM.
Methods: Traditional norming and psychometric analyses were conducted to evaluate the reliability and validity of the ToMI-2. The development of the Theory of Mind Atlas was guided by a comprehensive review of of the vast theory of mind literature. The goal is to summarize the state of the knowledge for each ToM domain identified in typical development as well as ASD, ADHD, and oral or late-signing children with hearing loss.
Results: The ToMI-2 was normed on children ages 2-13 and performed extremely well on all tests of psychometric rigor (reliability, validity). The Theory of Mind Atlas is now available for free to all registered users of Theoryofmindinventory.com. By design, the atlas is constantly being updated to add content and reflect the most up-to-date evidence.
Conclusions: The ToMI-2 and the Theory of Mind Atlas represent important contributions in our efforts to improve the range of tools available for assessing and for understanding (and communicating about) theory of mind.

274 **165.274** Internet Use in Individuals with Autism Spectrum Disorders: Content, Behaviors, and Correlations with Parent Reports

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Background: How children, adolescents, and adults with Autism Spectrum Disorders (ASDs) engage with content on the Internet has been of growing interest to families and clinicians and may be an area of concern for mental health. People with ASD may be at high risk for compulsive internet use and negative interactions with other users while communicating online.
Objectives: This study sought to identify how children, adolescents, and adults with ASDs are using the Internet, as well as the degree to which parents are aware of this use.
Methods: 33 parent and participant pairs were enrolled through an outpatient psychiatric clinic setting (average participant age: 14.3 years old) in which participants were diagnosed with ASDs. Parents and participants were recruited if they were able to answer our written questionnaire on Internet use. This included questions regarding average time spent daily on the Internet, categories of Internet usage (gaming, social media, shopping, watching videos, etc.), social Internet activities performed (picture sharing, discussion boards, write a contribution, etc.), use of the Internet for ASD information, compulsive Internet Usage (using Young's Internet Addiction Test (1999)), Internet safety. Parents also filled out the Social Responsiveness Scale (SRS). Participant use of internet was examined and compared with parent reports of internet use. Correlations were used to examine relationships between compulsive internet use and ASD symptoms.
Results: Average Total SRS scores for participants was 80 (SD 8.1). Parents reported an average of 2 to 4 hours of Internet use with their children, while participant estimates were slightly higher at 3 to 5 hours of daily Internet use (S.D. 1.7 and 2.1, respectively). There was a statistical association between child and parent responses (p=0.00), with a correlation of 0.75 from parent to child. The most popular categories of Internet use were Video Gaming and Watching videos. This was followed by Social Media, Watching TV series/anime/Movies, and Listening to Music. Parents and children indicated the same ranking of categories by total response, demonstrating a high degree of knowledge on the parents' part of the preferred and most used types of Internet use. The most popular social Internet activities reported by participants were viewing other people's videos and pictures as well as looking for new information (81.82%). The majority of parents (69.7%) answered that they use the Internet to find information about autism, in comparison to only 27.27% of children who said they did the same. Results for Young's Internet Addiction Test were suggestive of relatively low average compulsive Internet behavior among participants with ASDs. Both parents and children indicated mostly low levels of unsafe internet behavior, such as giving out personal information or encountering unwanted requests to engage in sexual activities or talk.
Conclusions: Internet use in individuals with ASDs does not appear to have significant compulsive qualities and parents are aware of their use. Further studies are needed to elucidate more on differences in Internet use between those who have ASDs and those who do not.

275 **165.275** Investigating Developmental Relations Between Social Reward, Social Cognition, and Symptom Severity in ASD.

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Background: The social motivation theory of autism posits that individuals with autism spectrum disorder (ASD) derive less reward from social interactions, which may result in a cascade of developmental deficits, including those of social cognition (Chevallier et al., 2012a; Dawson et al. 2005). However, while previous literature has linked increased social reward to decreased autistic-like traits (Chevallier et al., 2012b, Foulkes et al., 2015), few studies have examined developmental changes in social reward and in relations between social reward and social cognition from childhood through adulthood.
Objectives: We investigated age-related differences in social reward and explored relations between social reward and social cognition in participants with ASD between middle childhood and adulthood.
Methods: To date, participants include 35 individuals diagnosed with ASD, aged 7-30 years (5 females, *Mean Age* =15.19, *SD*= 5.90). We administered five subscales from the self-report Social Reward Questionnaire (SRQ) (Foulkes, Viding, McCrory & Newman, 2014): Admiration (e.g., "I enjoy it if others look up to me"); Negative Social Potency (e.g., "I enjoy tricking someone out of something"); Passivity (e.g., "I enjoy following someone else's rules"); Pro-social Interactions (e.g., "I enjoy treating others fairly"); Sociability (e.g., "I enjoy going to parties") The ADOS-2 was administered to confirm clinical cut-off and estimate symptom severity. Finally, social cognitive measures Reading the Mind in the Eyes task (RMET) and Strange Stories were given.
We used correlation analyses to examine the relation between symptom severity and social reward. To investigate age-related changes in social reward, we conducted correlations between age and social reward subscales, separately, while controlling for symptom severity (ADOS Symptom Severity Index). To examine age-related changes in the relation between social reward and social cognition, we ran regressions with age and social reward as predictors of social cognitive measures, separately.
Results: We found a negative correlation between the Pro-Social Interactions subscale of the SRQ and ADOS total severity scores (r = -.404, p = .032), even when controlling for age (r = -.424, p = .034). There was a positive correlation between age and the Pro-Social Interactions (r = .459, p = .021) subscale of the SRQ, and a negative correlation between age and the Negative Social Potency subscale (r = -.425, p= .034). These correlations remained significant when controlling for ADOS total severity scores. Further, there was no significant relation between social reward and the social cognition measures.
Conclusions: Our results are consistent with the literature in that enjoyment of socially positive interactions negatively correlates with symptom severity. Further, our results indicate potential changes in social reward with age; specifically enjoyment of pro-social interactions may increase with age, and enjoyment of negative potency interactions may decrease with age, even when taking symptom severity into account. Finally, our results indicate that social reward may not be related to social-cognition within this age range. It is possible that the relation between these two factors plays a larger role earlier in development.

276 **165.276** Is Participation in Family Role-Play in Second Life Associated with Improved Social and Emotional Support and Well-Being Among Adults with Autism Spectrum Disorders?

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Background: Virtual worlds, such as Second Life (SL), may provide a venue to overcome social barriers and allow for the formation of meaningful relationships for some adults with Autism Spectrum Disorders (ASD) that have difficulty achieving these relationships in offline settings.
Objectives: This mixed methods study examines whether participation in SL among adults with ASD is associated with positive perceptions of emotional support and wellbeing.
Methods: A total of 91 participants were included in the study: 13 had ASD and used SL, 12 had ASD and did not use SL, 44 did not have ASD and were SL users, and 22 did not have ASD and did not use SL. Questionnaires and interviews with participants were used to collect the data.
Results: Individuals with ASD who participated in SL rated themselves significantly higher on measures of social fun, emotional support, and flourishing in SL than they did for real life (RL). In contrast, individuals with ASD who participated in SL reported lower social fun in RL than those who did not participate in SL.
Conclusions: While the results of the questionnaire data suggest that individuals who are attracted to SL report poorer social and emotional support and well-being offline, interviews with SL users revealed a more complex story. Participants described that the quality of social and emotional support in online situations is similar to social support received in SL among individuals without ASD. In addition participants described learning communication skills in SL that they were later able to apply to RL. This suggests that SL may create an environment where adults with and without ASD can perform equally.

277 **165.277** Joint Attention Difficulties in Autistic Adults: An Interactive Eye-Tracking Study

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Background: Joint attention – the ability to coordinate attention with a social partner – is critical for social communication, learning, and the regulation of interpersonal relationships. Infants and young children with autism demonstrate impairments in both initiating and responding to joint attention bids in naturalistic settings. However, little is known about joint attention abilities in adults with autism.
Objectives: In the current study we investigated joint attention abilities of autistic adults using a novel “virtual reality” task.
Methods: We tested 17 autistic adults and 17 age- and nonverbal IQ-matched controls. During testing, participants interacted via an eye-tracker with an on-screen avatar whom they were led to believe was controlled by another participant but was in fact programmed to respond dynamically to the participant’s own eye-movements. Together, the participant and avatar completed a “Catch the Burglar” task that required them both to initiate and respond to joint attention bids. Participants also completed a non-social control task that required the same pattern of eye-movements to be made in response to arrow rather than eye gaze cues.
Results: Compared to control participants, autistic adults completed significantly fewer trials successfully. They were also significantly slower to respond to joint attention bids in the first block of testing but performed as well as controls in the second block. Importantly, there were no group differences in the non-social task. In interviews conducted after the study, autistic participants commented that they initially found it challenging to communicate using eye gaze, but were able to develop strategies that allowed them to achieve joint attention.
Conclusions: This study provides the first evidence that subtle difficulties in joint attention persist into adulthood, at least for some autistic adults. The results contrast with previous studies of autism that find little evidence of impairment on computer-based gaze-cueing tasks. This, we argue, highlights the importance of embedding joint attention episodes in realistically complex social interactions in which participants have to determine the relevance of multiple social cues. Our study also demonstrates the potential and feasibility of virtual reality paradigms for studying social interaction difficulties within a controlled yet ecologically valid experimental context.

278 **165.278** Joint Attention, Social Referencing, and Theory of Mind in ASD and Non-ASD Children

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Background: Joint attention and theory of mind are both integral parts of a core social-communicative system that begins developing in infancy. While joint attention begins emerging between 6 and 15 months in typically-developing children, theory of mind begins emerging at around 4 years. Although longitudinal data suggests a relationship between joint attention and theory of mind, little is known about the extent of the relationship and variables that mediate the relationship. Because joint attention emerges before theory of mind, it is possible that joint attention deficits contribute to theory of mind deficits in children with autism spectrum disorder (ASD). Moreover, information regarding the development of joint attention beyond infancy in typically developed children is limited and may facilitate a better understanding of typical vs. atypical socio-cognitive development.
Objectives: The purpose of this study was to explore differences between children with ASD and typically developing children in theory of mind and rates of joint attention and social referencing and to examine the relationships between all three variables. In addition, the study examines the effect of age and joint attention and the effect of age and social referencing on theory of mind in both groups.
Methods: A sample of 20 children with ASD between the ages of 6 and 12 years were compared to a sample of 19 typically-developing children in the same age range. With the exception of one control, who was matched within 1-year, all controls were matched by gender and age within 6-months to children in the ASD group. The groups were assessed at the Eastern Michigan University Psychology Clinic on tests of intelligence and social functioning, including communication, social awareness, social affect, and theory of mind.
Results: The ASD group had lower overall levels of theory of mind and more specifically, verbal theory of mind, than the non-ASD group. In addition, in comparison to the non-ASD group, they had lower instances of initiated joint attention and social referencing. Age was shown to be positively related to theory of mind. In addition, bivariate relationships between language measures and theory of mind measures were found. Joint attention was found to predict theory of mind, with greater attention predicting greater theory of mind. Moreover, verbal language was also found to be related to theory of mind. No relationship between age and theory of mind, even as moderated by joint attention, was found for ASD and non-ASD participants.
Conclusions: Results suggest lower social functioning in the ASD group, as demonstrated by poorer theory of mind and lower rates of joint attention and social referencing. A relationship between language measures and theory of mind measures suggest that children may develop compensatory behaviors which allow them to achieve greater scores in theory of mind. Lastly, the findings suggest that joint attention and verbal language can be used as indicators of theory of mind abilities and deficits in those areas may perhaps be addressed to improve or prevent theory of mind deficits.

279 **165.279** Less Sensitive Face-Selective Responses in ASD Measured with Fast Periodic Visual Stimulation EEG

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Background:
Fluently recognizing faces and facial expressions is highly important for our social interactions. Impaired and atypical face processing have often been postulated as a key deficit in autism spectrum disorders (ASD). Despite the great amount of research on face identity and facial expression recognition in ASD, results are mixed. This is partly due to the widely used tasks tapping explicit face processing, which may give an incomplete estimate of face processing abilities in ASD.
Objectives:
Therefore, we wish to examine these face processing impairments in ASD with an innovative EEG approach. This method combines fast periodic visual stimulation (FPVS) with scalp electroencephalography (EEG). The main advantage of this new and highly versatile FPVS EEG approach is that it offers an objective, quantifiable and robust index of implicit face processing abilities, reliable at the individual level, within a few minutes of time and without any complex data analysis. The core idea of FPVS is that the periodicity of the electrophysiological response on the human scalp corresponds exactly with the periodicity (frequency) of the visual stimulation. Hence, it can be used for efficiently measuring categorization responses of complex visual stimuli in the human brain.
Methods: In this study, the ability to rapid categorization of natural face images was assessed. 25 high-functioning young boys with ASD (age 8-12) and 25 typically developing (TD) boys without any psychiatric disorder completed the FPVS EEG paradigm. In this paradigm, images of objects in their natural background are presented at a baseline frequency rate of 6 Hz. Every fifth image, widely variable face images appear in the sequence. If participants detect the periodic appearance of the face stimuli, a face-selective response is observed in the EEG at exactly 1.2 Hz (6/5). Further, participants completed computerized versions of the Benton Facial Recognition Test (BFRT) and the Cambridge Face Memory Test (CFMT). In addition to verbal, performal and total IQ, clinical assessments included questionnaires assessing quantitative autism characteristics (Social Responsiveness Scale), symptoms of depression (Child Depression Inventory), symptoms of anxiety (SCARED), symptoms of congenital prosopagnosia (adapted version of the 20-item prosopagnosia index), and the Child Behavior Checklist.
Results:
Results show that the paradigm seems to be able to discriminate between children with and without ASD. We observe that boys with ASD are at least as sensitive as TD boys to the periodic flickering of the stimuli at the base rate (6 Hz), indicating that they pay equal attention to the images presented on the screen. However, they are far less sensitive to the periodic appearance of the face stimuli at oddball rate (1.2 Hz). We will further expand these results by showing correlations between the FPVS paradigm and symptom severity and IQ scores.
Conclusions:
These results suggest that for boys with ASD, their neural system is less tuned to the socially relevant information on the screen, as their face-selective response is less sensitive compared to TD boys. Furthermore, the results indicate the strength of our technique as a powerful and sensitive tool to measure socio-communicative difficulties in ASD.

280 **165.280** Living with Autism As a University Student: An Irish University Experience

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Background: Â A recent autism prevalence study conducted in Ireland has shown Autism rates of 1%. The National Council for Special Education in Ireland recently published new policy advice on the education of people with Autism. One of the findings, underpinning the Council's advice, is that 1 in 65 or 14,000 students in National and Secondary school in Ireland have a diagnosis of Autism. This means that more people with Autism are attending education in Ireland than ever before.
Objectives:
The aim of our research project is to explore the college related experiences of students with autism attending an Irish University. Of particular interest is

- Their interactions with staff and other students
- Their teaching and learning experiences
- Their integration into the University community
- The physical campus environment
- Travel to and from campus

Methods:
Methods: There are three parts to this study
1) An online survey with students with autism attending university (n=50)
2) Semi-structured interviews or focus groups (n = 3 groups of 6-8) with key campus staff who regularly engage with students with autism
3) An online survey of the entire student body at the University to explore their attitudes and knowledge of autism (n= 16,000) pre an post a high profile awareness campaign
Results: Â Data from the 3 arms of the study above will be presented to give a picture of the issues arising for students attending university as well as the supports being put in place. Additional supports needed will be identified.
Conclusions: Â This study will identify what is currently working well for students with Autism in the University and where improvements could be made to make the University more "Autism-Friendly". It is hoped that a model will be developed which can be replicated in other HEIs.

281 **165.281** Mindfulness Training with Children on the Autism Spectrum: A Pilot Study Evaluating the Impact of Mindfulness on Social and Cognitive Outcomes

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Background: People with Autism Spectrum Disorder (ASD) face difficulties with social and emotional skills, including troubles understanding and managing emotions and succeeding in social interactions (Bellini, Peters, Benner, & Hopf, 2007). Many different interventions have been designed to improve social, emotional, and adaptive outcomes for people with ASD; however many of these programs do not create long lasting or generalizable change (Bellini et al. 2007). Mindfulness-based interventions aim to increase self-awareness and self-management skills. These therapies are growing in popularity and have shown positive results for improving social skills and executive functioning (higher-order thinking processes), and decreasing problem behaviours (Beauchemin, Hutchins, & Patterson, 2008; Khoury et al. 2013) in both typical and clinical populations. Since mindfulness has only recently emerged as a therapy for ASD, existing research is limited to evaluating adolescents and adults with ASD and typical children, rather than directly investigating approaches for children with ASD directly.
Objectives: To evaluate the effectiveness of Paws b, a recently developed mindfulness program (MiSP, 2015) specifically for children ages 7-11 years, to improve social skills, self-concept, executive functioning, and problem behaviours in children with ASDs.
Methods: Five children with ASD participated in the 7 week Paws b program (6 lessons and 1 booster class). The participants of this study were all boys with ASD (M = 8 years, 3. 4 months, Range = 6 years 10 months- 10 years). Two of the five children had comorbid diagnoses and were the only two participants on medication. Children completed the Beck Youth Inventory as a measure of Self-Concept. Parents completed the parent versions of both the Social Skills Improvement System (SSIS), which assesses Social Skills and Problem Behaviours, and the Behaviour Rating Inventory of Executive Function (BRIEF), which assesses Executive Functioning Skills. All data was compared using paired sample t-tests, and effect sizes were calculated for all results to indicate practical significance.
Results: Parent reports for Social Skills showed a significant increase following Paws b training, and children reported a significant increase in their Self-Concept following Paws b. While not statistically significant, improvement trends were noted in the areas of Executive Functioning or Problem Behaviours.
Conclusions: The results of this study indicate that Paws b shows promise to improve social skills and self-concept in children with ASD. Though there were no statistically significant improvements in the other measured variables, the subscales trended in the expected direction will be valuable resources for informing future research directions. The results of this study indicate that improvement trends may have been affected by the short program duration, which suggests that a longer program may result in noticeable improvements in more areas. However, effect size calculations indicate that some of the changes, while not statistically significant, were practically significant changes for the participants.

282 **165.282** Moderating Effects of Verbal IQ on Social Competence Intervention Outcomes

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Background: Students with autism spectrum disorders (and similar social challenges) often struggle social interactions with both peers and adults. Despite increased efforts to identify effective interventions to address these social competence challenges, few intervention studies examine characteristics that may be associated with higher or lower treatment response. Research implicates the role of verbal abilities on a variety of social functioning indicators of youth with ASD or similar social/behavioral challenges.
Objectives: The objective of the current study is to examine the moderating effect of student verbal IQ (VIQ) on treatment response, as measured by teachers' reports of social functioning, to a specified social competence curriculum.
Methods: This study utilizes data from a four-year cluster-randomized trial examining the efficacy of the Social Competence Intervention for Adolescents (SCI-A, *n* = 146) versus school-designated business as usual social programming (BAU, *n* = 128) for a range of middle-school students identified with social challenges (e.g., ASD, emotional behavior disorders, ADHD). The SCI-A curriculum is grounded in cognitive behavior intervention and includes specific social content and instructional strategies across all lessons. BAU settings varied considerably in their scope and delivery.Â Students across both conditions were primarily male (>84%) and mean full-scale IQ (FSIQ) scores in the average range. The majority of students had eligibility for special education services, with over 75% under the categories of autism or emotional/behavioral disturbance. For each student, one general education teacher completed the Social Responsiveness Scale, 2nd edition (SRS-2) at pre and post intervention.
Results: Â Controlling for relevant behavioral covariates and FSIQ, we conducted multilevel models testing moderating effects of VIQ and of VIQ/nonverbal IQ discrepancy on SCI-A's efficacy in improving teacher' reports of social outcomes. We examined the effect sizes simple slopes at lower (85) versus higher (115) levels of VIQ and at lower (-11) versus higher (+11) levels of VIQ to NVIQ discrepancy. Results indicated significant interactions between condition (SCI-A versus BAU) and students' VIQ (see Table 1) and the VIQ to NVIQ discrepancy (see Table 2). SCI-A had more positive impact than BAU on students' social awareness (*d* = .38), social communication (*d* = .50), and social motivation (*d* = .35) at lower levels of VIQ; these patterns were more pronounced when students had discrepantly lower VIQ than NVIQ (awareness *d* = .97, communication *d* = .97, motivation *d* = 1.34). For those at higher levels of VIQ and with discrepantly higher VIQ than NVIQ, SCI-A was less effective than BAU in improving students' social outcomes (*d*s > .47).
Conclusions: SCI-A demonstrated small to moderate effects on social awareness, communication, and motivation to be social for students with lower verbal abilities. SCI-A's consistency of concept language, cognitive strategies for social interpretation, and scaffolded opportunities to learn and practice skills may better address the needs and challenges of students who have lower verbal abilities than their higher ability peers. These findings have implications for understanding the role of VIQ in intervention response and determining what intervention features may be more impactful for students with lower versus higher verbal abilities.

283 **165.283** Music and Autism: Understanding the Role of Music in Everyday Life

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Background: In children and adults with autism, musical savantism occurs at elevated rates in autism. Indeed adults with autism perform better on some music performance tasks, including pitch perception. However, little is known about the role of music in their everyday life and why they engage and prefer music in unique ways.
Objectives: To map the role of music in the everyday lives of adults with higher functioning autism. Specifically, (1) to gain a broad picture of the uses and effects of music in autism, and (2) to investigate the cognitive factors that underlie differences between autism and control groups on musical consumption, engagement, preferences, evoked emotions, and peak experiences.
Methods: A range of musical assessments were administered online to multiple autism and control groups. These included measures of musical importance and consumption (n = 156 in the autism group and 142 in the control group); music engagement (n = 152 and 146), musical preferences (n = 97 and 135), music use and evoked emotions (158 and 271) and peak experiences (n = 89 and 127). The Empathizing Quotient (EQ), Systemizing Quotient-Revised (SQ-R), and Autism Spectrum Quotient (AQ) were administered to subsets of all the samples.
Results: Adults with autism showed clear differences from controls in how they use and are affected by music in everyday life. The autism group scored higher on cognitive/intellectual engagement with music, and preferred music with more intense and complex features. They scored higher on using music to get through difficult times and to be relieved of worries. They also scored higher on feeling wonder, transcendence, and tension from music. And responses on peak experiences demonstrated that music with patterns and repetition facilitated strong and intense reactions to music. The individual differences found in musical behavior were in part underpinned by cognitive 'brain type' classifications (as assessed through the EQ and SQ-R) and scores on the AQ.
Conclusions: This is one of the first comprehensive studies on music and everyday life in autism. The findings shed light on the link between autism and music and provide evidence for the cognitive factors that underlie this relationship by extending the empathizing-systemizing (E-S) theory to music. The findings also have the potential to inform treatments in music therapy and clinical settings.

284 **165.284** Naturalistic Assessment of Empathy and Social Cognition in Adolescent ASD – Eye-Tracking As Predictor of Performance and Behavioral Phenotypes in Clinical and General Populations

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Background: Empathy and social cognition are the basis of our social functioning and they are deviating in autism spectrum disorders (ASD; Harms et al., 2010; Bons et al., 2013; Senju, 2013). Questionnaire measures or abstract tests often fail to capture deviating empathy and social cognition in adolescent ASD, which can be attributed to compensating strategies in lab experiments that are revealed by eye-tracking methodology (Senju et al., 2009; Chevallier et al., 2015). Aberrant empathy in ASD may also reflect the endpoint of a trait continuum in the normal population that is different to aberrant empathy in conduct disorder
Objectives: The Multifaceted Empathy Test – Junior Revised (MET-JR) and the Movie for the Assessment of Social Cognition (MASC) were adapted for adolescent age ranges and investigated in three independent samples (MET-JR clinical sample: n = 57, MASC clinical sample: n = 56, MET-JR community sample: n = 215).
Methods: The original MET is a picture-based measure of cognitive and emotional empathy (Dziobek et al., 2007), while the MASC is a video-based behavioral test of inferring others' mental and emotional states (Dziobek et al., 2006). The MASC was assessed with concurrent eye-tracking. We conducted factor and psychometric analysis of our naturalistic measures in comparison to common questionnaires and tests (MASC vs. SRS, RMET, and EQ; MET-JR vs. SRS, GEM, and ICU).
Results: The MET-JR and the MASC were validated as ecologically-valid estimate of empathy (α = .71-.96) or social cognition (α = .74-.84) as they correlated significantly with related measures (r = .39 - .53) and associated constructs (r = -.37 - .59), but not significantly with cognitive ability or age. Both measures were able to differentiate ASD from clinical control groups, with AUC = .87 and AUC = .75, and delivered large effects by comparing ASD and non-ASD groups, with d = 1.1 – 2.4 and d = 0.9. Concerning the MET-JR, distinct clinical empathy profiles found for ASD and conduct disorder were replicated as disjoint empathy continua in the community sample. Concerning the MASC, smaller pupil sizes were observed for ASD (d = 0.6) and fixation on eyes positively predicted performance (f^2 = 0.15). However, exploratory factor analysis retrieved a single-factor solution for the MASC with R^2 = .36, while confirmatory factor analysis of the MET-JR partially delivered insufficient fit indices (RMSEA = .066).
Conclusions: We delivered naturalistic assessment tools of the interrelated constructs of empathy (MET-JR) and social cognition (MASC). We showed aberrant performance in both measures for adolescent ASD that can be related to empathy trait continua in the normal population and be predicted by gaze behavior. Nonetheless, factor analyses revealed that we have not sufficiently understood the latent construct structure of empathy and social cognition that also show conceptual overlap (Schaafsma et al., 2015). This could be overcome by a replication with a larger sample assessed with both naturalistic measures, the MET-JR and the MASC.

285 **165.285** Offending, Social Vulnerability and Compliance in Autism: The Moderating Effect of Theory of Mind

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Background: People with a diagnosis of Autism Spectrum Disorder (ASD) are reported to be disproportionately highly represented within the prison population. In a survey of 1,344 individuals with ASD from the general population, 37% reported that they had been forced or manipulated to do something that they did not want to do by someone they thought of as a friend - including criminal behaviours (National Autistic Society, 2014). Beyond this, little is known about the ASD offender profile and why they may offend. Wider literature suggests that social vulnerability and compliance may be factors relevant to ASD and related to offending, especially co-offending with others. In addition, Theory of Mind (ToM) abilities are theorised to be a core deficit in ASD and have been found to be impaired in criminal offenders (without ASD). This is pertinent as ToM has been suggested to have a moderating effect on social vulnerability, however, there is no data on the moderating effect of ToM upon compliance. To date, only one paper has examined ToM in criminal offenders with ASD and reported that the ASD offenders had better ToM than ASD non-offenders – but these differences were non-significant. To date, no single research paper has looked at social vulnerability, compliance and ToM in ASD populations with a focus upon criminal offenders.
Objectives: The study had two objectives: 1) to investigate whether ASD offenders typically offend alone or with other people; 2) to identify the extent to which social vulnerability and compliance distinguish criminal offenders with and without ASD, and to what extent does ToM moderate these relationships.
Methods: Seventy-nine participants with ASD (39 offenders; 40 non-offenders) and 78 typically developed (TD) participants (39 offenders; 39 non-offenders) completed the two sub-test version (vocabulary and matrix reasoning) of the Wechsler Abbreviated Scale of Intelligence (Wechsler, 1999), the Social Vulnerability Scale (Pinsker et al., 2006), the Gudjonsson Compliance Scale (Gudjonsson, 1989) and the solo/co-offending questionnaire designed for this study.
Results: Results indicated ASD offenders were significantly more likely to commit crimes alone than with other people. Initial findings indicated increased social vulnerability and compliance within both ASD groups (offenders; non-offenders) and also the TD offender group when compared to TD non-offenders (controlling for IQ). However, when both ToM and IQ were controlled for, the results indicate that ToM moderated the differences observed between the groups.
Conclusions: Convicted offenders with ASD typically commit crimes alone as opposed to with others. The expected finding of increased social vulnerability and compliance in the ASD groups (offenders; non-offenders) and in the TD offenders when compared to TD non-offenders was removed when accounting for ToM. The findings are therefore consistent with the broader literature identifying deficits in ToM in both ASD populations and criminal offenders, which may explain the higher-than-expected prison population of people with ASD. Understanding more about the moderating effect of ToM will allow not only interventions to help increase awareness and reduce manipulation (into both offending and non-offending behaviours) but also could be used to design intervention/strategies for reducing recidivism.

286 **165.286** Parent-Child Interaction and Peer Relationships in School-Age Children with ASD

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Background: Peer competence and friendships are important achievements for school-age children. However, peer relationships and contributors to success in this domain among children with ASD are not well understood. Better language ability has been associated with better peer competence in children with ASD. Parent-child interaction patterns characterized by shared control are associated with increased peer competence and higher-quality friendships in children with typical development, but this has yet to be demonstrated in children with ASD.

Objectives: 1) Compare peer competence and friendships in school-aged children with ASD and TD. 2) Examine the relationship between communication ability and parent-child shared control in preschool to peer competence and friendships in school-age.

Methods: This study included 26 children with ASD (20 male) assessed at preschool-age (*M*=4.3 years) and school-age (*M*=11.7 years) and 25 peers with TD assessed at school-age (18 male; *M*=10.45 years). School-age IQ ranged from 30-128 in the ASD group. Preschool parent-child interaction in the ASD group was microanalytically coded (Relationship Affect Coding System; Peterson et al., 2010) to quantify shared control during play. Higher values of Shared Control (ratio of parent questions + directives to child questions + directives) indicated more parental control. Preschool and school-age communication was measured with the Vineland. School-age peer competence (Social Skills Responsiveness Scale) and friendship quality (Friendship Qualities Scale, FQS; Bukowski et al., 1994) were measured via parent report.
Results: Children with ASD had lower Peer Competence and Friendship Quality than children with TD (2-tailed *t*-tests, *p*s<.001). Almost 70% of children with ASD (18/26) and all children with TD had one or more friends. Two hierarchical multiple regression analyses were performed. For Peer Competence: Block 1, (NVIQ and age), was significant, R^2=.33, *p*<.001. Block 2, (Group and school-age Communication), was significant, R^2_{change}=.30, *p*<.001. For Friendship Quality: Block 1, (NVIQ and age) was significant, R^2=.11, *p*<.05. Block 2, (Group and school-age Communication) was significant, R^2_{change}=.25, *p*<.01. Shared Control correlated with Peer Competence, (*r*=-.44, *p*<.05), but not Friendship Quality. To examine the relationship between Shared Control and Peer Competence, a multiple linear regression was performed. Block 1, (preschool Communication) was at trend level, R^2=.135, *p*=.08, f^2=.26. Block 2, (Shared Control), was at trend level, R^2_{change}=.07, *p*=.08. This study is ongoing, and the final analyses will include four in-process subjects who have not yet completed the study.

Conclusions: Many school-age children with ASD have at least one friend, indicating that children with a range of communication abilities and intellectual functioning can develop reciprocal friendships. However, most children with ASD and poorer communication had lower peer competence and friendship quality. A trend level association between shared parent-child control of interactions was detected, but future studies are needed to further elucidate the potential relations between parent-child interaction and later peer relationships. Better understanding of precursors to peer competence and friendships is needed to build evidence-based interventions for improving outcomes for school-aged children with ASD.

Oral Session -
172 - Welcome Address & Sponsor Update
8:45 AM - 9:00 AM - Yerba Buena 8-9

8:45 Welcome Address & Sponsor Update (Sat)

Keynote Address
173 - Developmental Endophenotypes to Quantify the Emergence of Autism in Infancy
9:00 AM - 10:00 AM - Yerba Buena 8-9

Speaker: A. Klin and W. Jones, Marcus Autism Center, Children's Healthcare of Atlanta & Emory University School of Medicine, Atlanta, GA

Reciprocal social engagement is a fundamental platform for infant brain development, fueling the emergence and refinement of social and communicative skills and facilitating a cascade of key neurodevelopmental milestones. In particular, the immediate postnatal state is marked by neoteny and extreme neuroplasticity: because human infants enter the world in such a fragile state, their survival depends upon a parent or caregiver's near-constant care. As a result, the fast pace of infant brain growth and specialization is typically enacted within a very specific context: reciprocal social engagement. This presentation focuses on the quantification of *social visual engagement* – the way in which infants visually explore, engage with, and ultimately learn from and adapt to their surrounding world. We focus on a series of experimental studies probing the first 2 years of life. Results indicate that social visual engagement is under stringent genetic control, is highly conserved across human and non-human primate species, and is pathognomonically impaired in infants later diagnosed with autism. Together, these findings implicate social visual engagement as a neurodevelopmental endophenotype for autism and also augur a new generation of human and cross-species gene-brain-behavior studies to advance understanding of the pathobiology of autism.

9:00 Developmental Endophenotypes to Quantify the Emergence of Autism in Infancy

A. Klin *and W. Jones, Marcus Autism Center, Children's Healthcare of Atlanta & Emory University School of Medicine, Atlanta, GA*

Reciprocal social engagement is a fundamental platform for infant brain development, fueling the emergence and refinement of social and communicative skills and facilitating a cascade of key neurodevelopmental milestones. In particular, the immediate postnatal state is marked by neoteny and extreme neuroplasticity: because human infants enter the world in such a fragile state, their survival depends upon a parent or caregiver's near-constant care. As a result, the fast pace of infant brain growth and specialization is typically enacted within a very specific context: reciprocal social engagement. This presentation focuses on the quantification of *social visual engagement* – the way in which infants visually explore, engage with, and ultimately learn from and adapt to their surrounding world. We focus on a series of experimental studies probing the first 2 years of life. Results indicate that social visual engagement is under stringent genetic control, is highly conserved across human and non-human primate species, and is pathognomonically impaired in infants later diagnosed with autism. Together, these findings implicate social visual engagement as a neurodevelopmental endophenotype for autism and also augur a new generation of human and cross-species gene-brain-behavior studies to advance understanding of the pathobiology of autism.

Panel Session

174 - Building a Phenotype: Discoveries of Genetically Distinct Subtypes of ASD

10:30 AM - 12:00 PM - Yerba Buena 3-6

Panel Chair: Caitlin Hudac, *Psychiatry & Behavioral Sciences, University of Washington, Seattle, WA*

Discussant: Raphael Bernier, *University of Washington Autism Center, Seattle, WA*

The significant etiologic and phenotypic heterogeneity of autism spectrum disorder (ASD) has made it challenging to target underlying mechanisms of ASD pathology and identify replicable biomarkers. A burgeoning "genetics-first" approach has been proposed to reduce heterogeneity and enable identification of subtypes of individuals with ASD across multiple physiological and behavioral systems. To make progress in the development of ASD biomarkers, we must establish the connection between behavior and the underlying physiology associated with etiologically defined subgroups. In this panel, we will focus on recent discoveries spanning multiple units of analysis to describe ASD phenotypes of children and individuals with genetic variants. We will begin by identifying behavioral patterns of syndromic ASD associated with de novo mutations and copy number variations (Stessman). We will then present data connecting behavior and physiology for specific genetic subtypes, including eye gaze phenotypes in PTEN carriers (Frazier), EEG resting state phenotypes in 15q11.2-13 duplication carriers (Jeste), and EEG dynamic patterns of attention in SCN2A carriers (Hudac). We will discuss common strategies and underlying mechanisms across these topics and the relevance of genetically distinct subtypes for the identification of biomarkers in ASD.

10:30 **174.001** Targeted Sequencing Identifies 90 Neurodevelopmental Disorder Risk Genes with Autism and Developmental Disability Biases

H. A. F. Stessman[1], *B. Ziong*[2], *B. P. Coe*[3], *T. Wang*[4], *K. Hoekzema*[3], *T. Turner*[5], *G. Santen*[6], *J. Gecz*[7], *C. Schwartz*[8], *F. Kooy*[9], *C. Romano*[10], *E. Courchesne*[11], *D. G. Amaral*[12], *I. Scheffer*[13], *F. Hormozdiari*[3], *H. Peeters*[14], *M. Nordenskjöld*[15], *A. Schenck*[16], *R. Bernier*[17] *and E. E. Eichler*[3], *(1)Pharmacology, Creighton University School of Medicine, Omaha, NE, (2)Department of Forensic Medicine and Institute of Brain Research, Huazhong University of Science and Technology, Wuhan, Hubei, China, (3)Department of Genome Sciences, University of Washington, Seattle, WA, (4)The State Key Laboratory of Medical Genetics, School of Life Sciences, Central South University, Changsha, Hunan, China, (5)University of Washington, Bothell, WA, (6)Clinical Genetics, Leiden University Medical Center, Leiden, Netherlands, (7)Robinson Research Institute, University of Adelaide, North Adelaide, Australia, (8)J.C. Self Research Institute of Human Genetics, Greenwood Genetic Center, Greenwood, SC, (9)University of Antwerp, Edegem, BELGIUM, (10)Unit of Pediatrics & Medical Genetics, IRCCS Associazione Oasi Maria Santissima, Troina, Italy, (11)University of California, San Diego, San Diego, CA, (12)Department of Psychiatry & Behavioral Sciences, University of California-Davis, Sacramento, CA, (13)Department of Paediatrics, University of Melbourne, Royal Children's Hospital, Melbourne, Victoria, Australia, (14)Centre for Human Genetics, KU Leuven and Leuven Autism Reasearch, Leuven, BELGIUM, (15)Center for Molecular Medicine, Department of Molecular Medicine and Surgery, Karolinska Institutet, Stockholm, Sweden, (16)Department of Human Genetics, Radboud University Medical Center, Nijmegen, Netherlands, (17)University of Washington Autism Center, Seattle, WA*

Background: *De novo* and rare, gene-disruptive mutations are known to contribute to the biology of neurodevelopmental disorders (NDDs), including autism spectrum disorders (ASD) and intellectual disability/developmental disability (ID/DD), but the pathogenicity of several hundred candidate genes that have emerged from whole-exome sequencing studies has yet to be established. Advances in next-generation sequencing technology have enabled systematic screening of tens of thousands of individuals to identify individually rare *de novo* events in the most important risk genes. Phenotypic follow-up of probands broadly drawn from NDDs has allowed us to explore specific clinical phenotypes in a genotype-first manner.

Objectives: Using a targeted sequencing approach, we aimed to screen over 10,000 NDD probands for disruptive variation in high-impact genes curated from published exome sequencing studies to identify individuals carrying novel *de novo* events, proving the statistical significance of specific genes. While disruptive genetic events may be individually rare, by leveraging samples and data from multiple comorbid conditions (e.g., ASD and ID/DD), we increase our sensitivity to identify the most important risk genes.

Methods: We applied single-molecule molecular inversion probes to sequence 208 candidate genes from an international cohort of 13,475 NDD probands (n=6,410 with a primary diagnosis of ASD and n=7,065 with ID/DD) and 2,867 unaffected sibling controls. Samples were collected as part of an international consortium termed the ASID (Autism Spectrum/Intellectual Disability) network that involved 15 centers across seven countries and four continents where patients were largely consented for clinical follow-up.

Results:

We report 90 genes that show an excess of *de novo* mutations or an overall burden of private, disruptive mutations in 5.4% of patients screened in the study compared to unaffected controls. We identify 44 novel NDD genes that reach locus-specific significance (e.g., *NAA15*, *KMT5B*, *ASH1L*, *KATNAL2* and *NCKAP1*) and confirm the importance of previously reported high-impact genes (e.g., *SCN2A*, *ARID1B*, *ADNP*, *CHD8* and *POGZ*). Neuronal-based assays for a subset of genes in *Drosophila* as a model system add further evidence to bolster their involvement in NDDs, including genes at the cusp of statistical significance. While many genes are clearly risk factors for NDD broadly, secondary analyses of both the genetic burden and subsequent patient follow-up for 25 genes in 303 patients highlights genes with a statistical bias toward ASD versus ID/DD diagnosis. We find that patients with mutations in genes enriched for ASD show significantly lower rates of seizures ($p = 1.20x10^{-4}$), congenital abnormalities ($p = 1.88x10^{-2}$), and microcephaly ($p = 1.79x10^{-7}$) but higher rates of macrocephaly ($p = 5.25x10^{-3}$) compared to comorbid ASD and ID/DD genes and strong ID/DD genes. Clinical follow-up for specific genes—*NAA15*, *KMT5B* and *ASH1L*—reveals novel syndromic and non-syndromic forms of disease with variable penetrance.

Conclusions: In total, 43% (90/208) of our candidate genes reach locus-specific significance for disruptive mutations, closely matching empirical expectations based on the mutational differential between probands and unaffected siblings. We observe evidence of phenotypic bias (ASD versus ID/DD) for severe mutations in 25 genes, specifically highlighting a gene network associated with high-functioning autism (FSIQ > 100).

10:50 **174.002** Cognitive, Behavioral, and Eye Gaze Patterns in Patients with Germline Heterozygous PTEN Mutations and Autism Spectrum Disorder

T. W. Frazier[1], *E. W. Klingemier*[1], *E. E. Zetzer*[1] *and C. Eng*[2], *(1)Cleveland Clinic Center for Autism, Cleveland, OH, (2)Genomic Medicine Institute, Cleveland Clinic, Celeveland, OH*

Background: A growing body of literature has identified a relationship between the tumor suppressor gene *PTEN* and autism spectrum disorder (ASD) with macrocephaly (PTEN-ASD). Our initial cohort study found that PTEN-ASD patients had lower PTEN protein levels, abnormal brain white matter, and reduced cognitive function (IQ, working memory, and processing speed) relative to other macro- and normo-cephalic ASD patients and healthy controls. Yet, beyond this initial study, there is limited data on specific neurobehavioral phenotypes associated with PTEN-ASD.
Objectives: Our primary aim was to leverage detailed cognitive and symptom data collected in our initial cohort to compare the neurobehavioral characteristics of PTEN-ASD cases relative to other ASD and control cases. The secondary aim was to conduct a preliminary analysis of eye gaze data to social stimuli collected from a new cohort of PTEN cases.
Methods: In our initial cohort (17 PTEN-ASD, 16 macro-ASD, 38 normo-ASD, and 14 controls), measures of autism symptoms, other psychopathology domains, child and family quality of life, attention, motor, and affective processing were collected. In our new cohort, remote eye gaze tracking was conducted from 8 PTEN patients and 18 age- and sex-matched healthy controls while they viewed brief videos depicting side-by-side faces, natural interactions, joint attention bids, and social versus abstract stimuli. Fixation duration was computed to specific regions-of-interest within each stimulus. In both samples, generalized estimating equation analyses examined group differences across neurobehavioral and eye gaze measures.
Results: Consistent with our previous findings, parent-reported and clinician-observed autism symptoms were highly similar across PTEN-ASD patients and other ASD groups. However, gross motor, and to a lesser extent, fine motor problems were more substantial in PTEN-ASD patients than other ASD groups (Figure 1a). PTEN-ASD patients were also rated as showing less emotion dysregulation (Figure 1b), anxiety/fear, aggression, and self-injury than other ASD groups. On cognitive testing, PTEN-ASD patients had problems with sustaining attention (Figure 1c), but were not impulsive. Affect and prosody recognition was impaired in PTEN-ASD relative to other ASD groups, but this was no longer significant after adjusting for IQ. The IQ reductions observed in PTEN-ASD patients were completely accounted for by impaired sustained attention, processing speed, and working memory. Quality of life, communication skills, and other psychopathology measurements were comparable across all ASD groups. In our new cohort, PTEN-ASD patients showed significant and dramatic reductions in eye gaze to socially-relevant regions-of-interest across 3 of the 4 stimuli (Figure 1d).
Conclusions: A PTEN-specific phenotype of ASD is emerging. The profile is characterized by generally reduced, but still variable, IQ - resulting from impairments in sustained attention, processing speed, and working memory. Also present is decreased fine and gross motor function, but PTEN-ASD patients ascertained to date had fewer behaviors suggestive of emotional dysregulation. Intriguingly, PTEN-ASD patients show highly similar autism symptom and eye gaze patterns to other ASD cases. These data support early referral of PTEN-ASD cases to occupational and physical therapy and suggest specific behavioral approaches to maximize sustained attention and reduce the impact of impaired processing speed and working memory.

11:10 **174.003** Electrophysiological Biomarkers of Dup15q Syndrome: From Mechanism to Clinical Implications of Functional Biomarkers in Autism Genetics

S. S. Jeste[1], *J. Frohlich*[2], *P. Golshani*[3], *L. Reiter*[4], *E. H. Cook*[5], *R. Sankar*[3] *and D. Senturk*[6], *(1)UCLA, Los Angeles, CA, (2)University of California, Los Angeles, Los Angeles, CA, (3)Center for Autism Research and Treatment, University of California, Los Angeles, Los Angeles, CA, (4)University of Tennessee Health Science Center, Memphis, TN, (5)Psychiatry, University of Illinos at Chicago, Chicago, IL, (6)University of California Los Angeles, Los Angeles, CA*

Background: The surge in genetic testing for children with Autism Spectrum Disorder (ASD) has facilitated the identification of causative rare genetic variants and the recognition of clinically meaningful genetic syndromes (Jeste and Geschwind, 2014). Insights into specific neurobiological mechanisms of disease also pave the way for the identification of genetically informed, brain based biomarkers that can enhance translational studies and clinical trials. Duplications of 15q11.2-q13.1 (Dup15q syndrome) are highly penetrant for autism spectrum disorder (ASD), with the duplicated 15q region containing several genes critical for brain development and excitatory/inhibitory balance (UBE3A and $GABA_A$ receptor genes). An electrophysiological (EEG) pattern characterized by excessive activity in the beta (15-30 Hz) band has been noted in clinical reports (Urraca, 2013), likely rooted in disruption of GABAergic tone.
Objectives: We asked whether spontaneous EEG oscillatory power distinguished children with Dup15q syndrome from those with non-syndromic ASD and then examined the clinical correlates of this electrophysiological biomarker in Dup15q syndrome (Frohlich et al, under review).
Methods: In the first study, we recorded spontaneous EEG from children with Dup15q syndrome (n = 11), age-and-IQ-matched children with ASD (n = 10) and age-matched typically developing (TD) children (n = 9) and computed relative power in 6 frequency bands for 9 regions of interest (ROIs). Group comparisons were made using a repeated measures analysis of variance. In the second study, we partnered with the national Dup15q Alliance and recorded spontaneous EEG from a larger cohort at the biannual Dup15q Family Meeting (n=27). We then examined age, epilepsy, and duplication type as predictors of beta power using linear regressions.
Results: Spontaneous beta1 (12 – 20 Hz) and beta2 (20 – 30 Hz) power were significantly higher in Dup15q syndrome compared with both comparison groups, while delta power (1 – 4 Hz) was significantly lower than both comparison groups. Effect sizes in all three frequency bands were large ($|d| > 1$, $|d|>1.7$ in beta2). Beta2 power was significantly related to epilepsy diagnosis in Dup15q syndrome. In a subset of participants with longitudinal data, beta power remained stable over time.
Conclusions:
Our findings have laid the foundation for a larger scale study of the functional and clinical implications of electrophysiological biomarkers in this syndrome. We are examining the stability of beta power and whether it is modulated with cognitive or perceptual tasks, or during sleep. One might hypothesize that persistent beta oscillations in sleep could disrupt sleep architecture enough to impact cognition and behavior in these children. A lack of modulation of EEG oscillations during cognitive tasks also could directly hinder learning. We also are quantifying EEG oscillations in several pre-clinical models of Dup15q syndrome in order to elucidate the specific role of UBE3A and $GABA_A$ receptor gene expression on this biomarker. We consider this study in the context of larger scale efforts in autism genetics to identify biomarkers that may facilitate clinical stratification, treatment monitoring, and measurement of target engagement for future clinical trials that target the putative effects of genes implicated in neurodevelopmental disorders.

11:30 **174.004** Dynamic Patterns of Attention in Children with Rare SCN2A Genetic Variants

C. M. Hudac[1], *T. DesChamps*[2], *B. E. Cairney*[3], *R. Ma*[4], *A. Wallace*[2], *V. Troiani*[5], *A. S. DiCriscio*[6], *C. M. Taylor*[7] *and R. Bernier*[3], *(1)Psychiatry & Behavioral Sciences, University of Washington, Seattle, WA, (2)University of Washington, Seattle, WA, (3)University of Washington Autism Center, Seattle, WA, (4)Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle, MA, (5)Geisinger-Bucknell Autism & Developmental Medicine Institute, Lewisburg, PA, (6)Geisinger ADMI, Lewisburg, PA, (7)Geisinger Health System, Lewisburg, PA*

Background: As described by Stessman in this panel, *SCN2A* is one of 87 genes that show an overall burden of private disruptive mutations in neurodevelopmental disorders, including ASD. Research in animal models highlights the critical role of SCN2A in controlling voltage-gated ion channels essential for the propagation of action potentials and neurotransmission. Despite extensive knowledge of molecular and cellular disruption, little is known about the neural phenotype associated with *SCN2A* mutations in humans, including domain general areas of cognition, such as attention.
Objectives:
We aimed to characterize dynamic patterns of attention associated with the *SCN2A* genetic variant. Targeted recruitment focused on children with ASD who had completed genetic testing in priori studies and had a gene disrupting mutation to *SCN2A*. Prior studies have found that children with ASD exhibit overall attenuation of the P3 component in response to standard and deviant stimuli (e.g., Salmond et al., 2007; Donkers et al., 2013). However, we hypothesized that children with ASD and a SCN2A mutation may showcase differences in functioning and ongoing changes throughout the duration of the experiment.
Methods: To date, participants (*N*=30) included children with *de novo SCN2A*, non-carrier biological siblings, and non-carrier biological parents (see Table 1 for participant demographic data). During EEG acquisition, children watched a video while passively listening to tones that varied in pitch (1000 or 1200 Hz) and duration (50 or 100 ms). In this way, we generated a standard condition (83%) and three possible deviant conditions (e.g., frequency only, duration only, frequency and duration; 5.5% each). A single-trial approach tracked dynamic patterns of attention (i.e., the variability of the P3a over the course of the experiment).
Results:
Preliminary analyses targeted peak latency across frontocentral scalp electrode clusters for the P3a component (180-350 ms). Multilevel models (SAS 9.4) tested habituation differences (i.e., the rate of decreasing P3a latency) in the dynamic context of time related to condition and group. A three way interaction between condition, group, and time was significant, $F(2,32000)=4.98$, $p=.0069$ and patterns are illustrated in Figure 1. Pairwise comparisons of habituation patterns show that *SCN2A* carrier P3a latencies were becoming increasingly faster for both deviant and standard tones. This pattern was significantly different than the slowing P3a latencies exhibited by parents (deviant diff.=-.33, $p=.038$; standard diff. = -.023, $p<.0001$) and siblings (standard diff =-.03, $p<.0001$).
Conclusions: Children with *SCN2A* mutations exhibit distinct dynamic patterns of attention in comparison to unaffected non-carrier biological relatives. These patterns were consistent, regardless of development, for continuous exposure to standard tones, suggesting an underlying genetically distinct subtype. Specifically, the response is increasing in efficiency for *SCN2A* carriers, which may suggest a delay in low-level sensory processing. In contrast, in response to deviant tones (i.e., novel stimuli), this pattern of habituation is common to both *SCN2A* carriers and siblings, but not parents, which may highlight underlying developmental changes. We will discuss implications for the *SCN2A* neural phenotype at the intersection of dynamic attention, sensory-seeking behaviors, and ASD symptomology.

Panel Session
175 - Mental Health Crises in Youth with Autism Spectrum Disorder
10:30 AM - 12:00 PM - Yerba Buena 7

Panel Chair: Luther Kalb, *Johns Hopkins School of Public Health, Baltimore, MD, Johns Hopkins School of Public Health, Baltimore, MD*

A mental health crisis occurs when an individual experiences an acute disturbance of thought, mood, or behavior and the resources available to manage the situation are not available at the time and place of occurrence. Clinical experience suggests such crises occur frequently among individuals with an Autism Spectrum Disorder (ASD) and that they have serious negative consequences for child and family functioning. Despite the scope and impact of this issue, there is no systematic research on the measurement or management of mental health crises in individuals with ASD. This panel addresses this gap from several perspectives. Mr. Kalb will present on the development and psychometric analysis of the first mental health crisis measure designed for youth with ASD. Dr. Vasa will describe results from the first national survey of child and adolescent psychiatrists examining management of mental health crises among youth with ASD. Dr. Righi will report on the factors related to inpatient psychiatric hospitalization among youth with ASD, an important setting for treatment of mental health crises. Dr. Siegel will conclude the panel by discussing the prevalence and correlates of suicidal expression, a critical and life-threatening symptom of crisis, among children and adolescents with ASD admitted to an inpatient psychiatric setting.

10:30 **175.001** Psychometric Analysis of the Mental Health Crisis Assessment Scale in Youth with Autism Spectrum Disorder

L. Kalb[1], *L. Hagopian*[2,3] *and R. A. Vasa*[2], *(1)Johns Hopkins School of Public Health, Baltimore, MD, (2)Kennedy Krieger Institute, Baltimore, MD, (3)Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, Baltimore, MD*

Background: Population-based research has shown that three quarters of youth with autism spectrum disorder (ASD) suffer from a co-occurring psychiatric disorder (Simonoff et al., 2008) and data from a clinic-based sample indicated that over 90% of referred youth with ASD have 3 or more psychiatric disorders (Joshi et al., 2010). Despite this burden, outpatient mental health providers who are available to work with this this population are scarce (Brookman-Frazee et al., 2012). This gap in care, along with clinical experience, suggests youth with ASD are risk for experiencing a mental health crisis. However, no measures of mental health crisis exist for this population.
Objectives: To examine the reliability and validity of a novel measure, the Mental Health Crisis Assessment Scale (MCAS).
Methods: Data used for this study were gathered from the Interactive Autism Network (IAN), an online US based research registry. Prior studies have established the validity of the ASD diagnosis in IAN (Daniels et al., 2011; Lee et al., 2010). For this study, parents had to report that their child was between 3-24 years of age and met the cutoff on the Social Communication Questionnaire (Rutter et al., 2003). A mental health crisis was defined as “an acute disturbance of though, mood, or behavior that requires immediate intervention” (APA, 2002). Mental health crisis was measured by the MCAS, a 28-item parent reported crisis measure made up of three sections, including a 14-item list of mental health symptoms, 7 items measuring acuity of symptoms, and 5 items assessing parental management of symptoms. Data were collected in three waves. The first wave (n = 121) were gathered to establish criterion validity by examining the association between the MCAS and a custom, semi-structured clinician interview. Construct validity was established through exploratory factor analysis (EFA; n = 229), in the first two waves of data collection, and independently corroborated through confirmatory factor analysis (CFA; n = 352) in the third wave of data collection. Convergent validity was determined by assessing the association between the MCAS and family distress (Weiss & Lunsky, 2010), parental stress (Macomber et al., 2006), and use of emergency psychiatric services in the third wave of data collection.
Results: Results from the EFA and parallel analysis identified a two-factor structure (Factor 1: behavioral acuity and Factor 2: behavioral management) of the MCAS. The CFA confirmed that the two factor model fit the third wave of data well (RMSEA = 0.10, CFI = 0.96, TLI = 0.95). The measure also demonstrated strong internal consistency values across all study waves (α ranged from 0.80-0.90). Results from the clinician interview analyses suggested a strong association between the MCAS and clinician opinion (ROC = 0.85). Lastly, positive associations were found between the MCAS and family distress (r = 0.57), parental stress (r = 0.48), and use of emergency psychiatric services (r = 0.67; all p<.05).
Conclusions: Results from this study support the MCAS as a psychometrically robust tool that can characterize a unique, important, and heavily understudied dimension of mental health among youth with ASD.

10:50 **175.002** Management of Mental Health Crises in Youth with and without Autism Spectrum Disorder: A National Survey of Child Psychiatrists

R. A. Vasa[1], *L. Kalb*[2], *E. Stuart*[3], *D. S. Mandell*[4] *and M. Olfson*[5], *(1)Kennedy Krieger Institute, Baltimore, MD, (2)Johns Hopkins University, Baltimore, MD, (3)Johns Hopkins School of Public Health, Baltimore, MD, (4)University of Pennsylvania, Philadelphia, PA, (5)Columbia University Medical Center, New York, NY*

Background: Â Youth with autism spectrum disorders (ASD) exhibit a host of dangerous behaviors, such as aggression, self-injury, and elopement (Simonoff et. al., 2008; Anderson et al., 2012). It is critical to understand if child and adolescent psychiatrists are equipped to manage these challenging behaviors. It is also important to investigate whether child and adolescent psychiatrists believe the resources available to manage mental health crises are accessible and useful. Gathering the perspective of these clinicians is particularly relevant since they are front line service providers for youth with serious mental health problems and key stake holders in the mental health system. To date, no study has examined child psychiatrists' management of mental health crises among youth with ASD.
Objectives: To examine: 1) whether child psychiatrists differed in their management of mental health crises between youth with and without ASD, and 2) whether there are differences in access to external resources to manage crisis-related events among youth with ASD compared to youth without ASD.
Methods: A 10-item custom online survey was administered to members of the American Academy of Child and Adolescent Psychiatry. The psychiatrists were divided into two groups based on the number of youth with ASD they cared for in their practice. Clinicians who routinely saw youth with ASD (n = 374) responded to questions pertaining to the ASD population only, while clinicians who did not see children with ASD (n = 492) responded to identical questions in reference to children without ASD. Weights were calculated to account for non-response and demographic differences between the ASD and non-ASD psychiatrist groups. Doubly robust linear regression models that employed the combined survey weights were used to examine differences in item means between psychiatrists treating youth with and without ASD.
Results: Both groups of psychiatrists were equally willing to accept youth with a mental health crisis into their practice, although 25% of all psychiatrists were not accepting any new patients with a history of mental health crises into their practice. Psychiatrists who cared for youth with ASD reported less access to other consulting mental health professionals ($p<0.05$) and less access to psychiatric crisis evaluation centers that could facilitate inpatient admission ($p<.05$). Psychiatrists who were providing services to youth with ASD were also less likely to recommend that parents take their child to the ED during a mental health crisis and reported less confidence in ED professionals ($p<.05$) and police ($p<.05$) to manage youth with ASD during a crisis, compared to those without ASD, in a safe and developmentally appropriate manner.
Conclusions: Child psychiatrists caring for youth with ASD need access to more resources to manage these patients during crises. In addition to developing best practice guidelines to manage youth with ASD in crises, the field is also in need of more child adolescent psychiatrists who are comfortable accepting and treating these young people.

11:10 **175.003** Predictors of Inpatient Psychiatric Hospitalization for Children and Adolescents with Autism Spectrum Disorder

G. Righi[1], *J. M. Benevides*[2], *C. A. Mazefsky*[3], *M. Siegel*[4], *S. J. Sheinkopf*[5] *and E. M. Morrow*[6], *(1)Alpert Medical School of Brown University, Rumford, RI, (2)RI-CART and ADDIRC, Somerset, MA, (3)Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA, (4)Maine Medical Center - Tufts School of Medicine - Spring Harbor Hospital, Westbrook, ME, (5)Brown Center for the Study of Children at Risk, Women and Infants Hospital, Providence, RI, (6)Department of Molecular Biology, Cell Biology and Biochemistry and Institute for Brain Science, Brown University, Providence, RI*

Background:
The presence of Autism Spectrum Disorder (ASD) has been associated with significant health care expenditures (Barrett et al. 2015; Hamdani and Lunsky, 2016; Mandell et al. 2006), due to greater utilization of a variety of medical and psychiatric health services including both inpatient and outpatient care, compared to individuals without ASD (Croen et al. 2006). There is reason to believe that service utilization is not evenly distributed across individuals with ASD and that there are certain risk factors that place individuals at a greater risk of requiring more services.
Objectives:
To determine factors that can identify children and adolescents with ASD at risk of psychiatric hospitalization.
Methods: Participants were selected from the Autism Inpatient Collection (AIC; n =218, 77% male, Mean age = 12.8y), and the Rhode Island Consortium for Autism Research and Treatment (RI-CART; n = 255, 80% male, Mean age = 12.3y,). Selected RI-CART participants had never been hospitalized for psychiatric reasons. Participants were frequency-matched on age and gender. All participants had: 1) a confirmed diagnosis of ASD, 2) a demographic questionnaire, 3) Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) with scores above the ASD cut-off, and 4) Vineland Adaptive Behavior Scales, Second Edition (VABS-2). Chi-square and independent sample t-tests were utilized to identify variables more prominent in the hospitalized sample. Significant predictors were entered in a multiple logistic regression model to examine their relative contribution to the likelihood of being psychiatrically hospitalized.
Results:
The AIC sample presented with higher rates of intellectual disability and nonverbal status ($\chi^2 = 67.1$, $p<0.0001$; $\chi^2 = 11.8$, $p = 0.001$, respectively), lower VABS-2 adaptive behavior composite score and communication, daily living skills, and socialization domain standard scores ($t(471) = 7.8$, $p<0.0001$; $t(471) = 7.5$, $p<0.0001$; $t(471) = 6.6$, $p<0.0001$; $t(471) = 7.9$, $p<0.0001$), higher ADOS-2 overall calibrated severity score ($t(435) = 3.5$, $p = 0.001$) and Social Affect severity score ($t(325) = 4.1$, $p <0.0001$), higher number of psychiatric diagnoses per individual ($t(471) = 5.2$, $p <0.0001$), higher rates of mood disorders diagnoses ($\chi^2= 62.7$, $p <0.0001$), and sleep problems ($\chi^2 = 36.6$, $p <0.0001$). More caregivers in the AIC sample reported being unmarried or without domestic partnerships ($\chi^2 = 15.2$, $p < 0.0001$). In the multivariate analyses, presence of a mood disorder (OR = 7.011, $p < 0.0001$), followed by the presence of current sleep problems (OR = 2.367, $p < 0.001$), and higher SA severity score (OR = 1.131, $p = 0.001$) predicted inpatient status. Having a higher VABS-2 adaptive behavior composite score (OR = 0.951, $p <0.0001$), and having a married or domestic-partnered primary caregiver (OR= 0.395, $p = 0.001$) decreased the likelihood of hospitalization.
Conclusions:
Findings reveal indicators that may identify children and adolescents at greater risk of psychiatric hospitalization. Our results underscore the importance of a multi-disciplinary approach to the assessment and treatment of children and adolescents with ASD that addresses behavioral, psychological/psychiatric, adaptive, medical, and family functioning in order to decrease the utilization of inpatient psychiatric services.

11:30 **175.004** Talking about Death or Suicide: Prevalence and Clinical Correlates in Youth with Autism Spectrum Disorder

M. Siegel[1], *A. Thurm*[2], *C. Farmer*[2], *J. A. Bridge*[3,4], *E. Lanzillo*[5], *R. Greenbaum*[6], *M. Pao*[5], *C. A. Mazefsky*[7] *and L. Horowitz*[5], *(1)Maine Medical Center - Tufts School of Medicine - Spring Harbor Hospital, Westbrook, ME, (2)National Institute of Mental Health, Bethesda, MD, (3)The Ohio State University, Columbus, OH, (4)The Research Institute, Nationwide Children's Hospital, Columbus, OH, (5)Intramural Research Program, National Institute of Mental Health, National Institutes of Health, Bethesda, MD, (6)Children's Mental Health Team, Surrey Place Centre, Toronto, ON, Canada, (7)Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA*

Background: Recent studies suggest that youth with Autism Spectrum Disorder (ASD) are at heightened risk for suicide, but these symptoms often go undetected (Bennett, 2016; Ludi et al., 2012). A significant barrier to accurately detecting suicide risk in ASD is a gap in knowledge about how suicidal thoughts are expressed in youth with ASD. Filling this gap is critical to inform suicide prevention strategies.
Objectives: To describe the prevalence of thoughts about death or suicide in a psychiatric inpatient sample of children and adolescents with ASD, with a range of intellectual ability and co-occurring psychiatric diagnoses, in order to inform suicide prevention strategies.
Methods: A parent reported item from the Child and Adolescent Symptom Inventory-5 (CASI-5), inquiring whether the youth recently "has periods lasting at least several days where he/she talks about death or suicide," was used to estimate prevalence of thoughts about death or suicide for 107 verbally fluent youth (nonverbal IQ >55, ages 10-18 years) with ADOS-confirmed ASD admitted a specialized psychiatric hospital unit (the Autism Inpatient Collection (AIC)). Consensus diagnoses for co-occurring psychiatric disorders were made by a child psychiatrist and unit clinician with expertise in assessment of co-occuring psychopathology in ASD.
Results: Per parent report, 23% of youth with ASD talked about death or suicide "often" or "very often." Clinical correlates included the presence of co-occurring depression (OR=2.71, 95% CI 1.12-6.55) or anxiety disorders (OR = 2.32, 95% CI 1.10-4.93). Demographic factors, including NVIQ, sex, race, and age, were not significantly associated with talking about death or suicide (p>.05).
Conclusions: Talking about death or suicide was a common occurrence in verbally fluent youth with ASD admitted to inpatient psychiatric units. The principal factors related to talking about death or suicide were depressive and anxiety disorders. This was particularly notable because youth with ASD are most frequently admitted to psychiatric hospital units due to externalizing behaviors, such as aggression toward others and property destruction, rather than internalizing problems (Siegel et al., 2011). As prior research has highlighted the under-reporting of suicidal thoughts in typically developing youth, our results may also be an underestimate. Screening for suicidal thoughts in this population can be confounded by some of the challenges inherent to ASD. This includes, but is not limited to, difficulty in identifying self-states, having restricted interests in morbid or negative topics, and displaying deficits in social pragmatics when making suicidal statements to gain attention or escape demands. These challenges and the high prevalence reported here suggest an urgent need for developmentally appropriate suicide risk screening measures for youth with ASD to inform suicide prevention strategies.

Panel Session
176 - The Continuum of ASD Across the Lifespan: Stability and Change in Symptoms, Cognitive Skills and Adaptive Functioning Based on Four Independent Cohorts
10:30 AM - 12:00 PM - Yerba Buena 8

Panel Chair: So Hyun Kim, *Center for Autism and the Developing Brain, White Plains, NY*

Discussant: Vanessa Hus Bal, *STAR Center for ASD & NDD; Dept of Psychiatry, University of California, San Francisco, San Francisco, CA*

As ASD is a lifelong developmental disorder, there is a need to examine behavioral trajectories from the emergence of symptoms to long-term outcomes. This panel aims to shed light on the developmental continuum of ASD based on data from four independent cohorts followed during different developmental stages from infancy to middle adulthood. The first presentation examines trajectories of directly observed ASD symptoms in a cohort of infants and toddlers seen approximately every 1-6 months from 1-3 years. The second presents ASD symptom trajectories based on parent interviews repeated on five occasions between 2-18 years and their relation to parent-reported language. The third uses multiple assessment modalities to demonstrate changes in ASD and mental health symptoms, as well as cognitive and adaptive functioning from 12-16 years in a population-based sample. The last compares child and middle-adulthood ASD symptoms, IQ and adaptive behavior in a 30-year follow up study of individuals initially assessed between 2-16 years. By providing insight into stability and change across different developmental periods, these studies highlight methodological challenges to assessment of individuals with ASD. Taken together, findings underscore the need for careful diagnostic, behavioral and intellectual assessment capturing variability in trajectories and outcomes over time.

10:30 **176.001** Patterns of ASD Symptom Trajectories in Infants and Toddlers Followed from 12 to 36 Months of Age

S. H. Kim[1] *and C. Lord*[2]*, (1)Center for Autism and the Developing Brain, White Plains, NY, (2)Psychiatry, Weill Cornell Medical College, White Plains, NY*

Background: Studies of children with ASD have demonstrated significant variability in 2-year trajectories in ASD between 12–18 months. Examining varying trajectories that characterize early development in ASD will aid in better understanding of the prognosis as well as phenotypic markers for different neurobiological subgroups.
Objectives: This study examined symptom trajectories in infants and toddlers referred for possible ASD and other developmental disorders as well as typical controls using a high-density of observations from 12-36 months of age.
Methods: A total of 153 children (103 ASD) with baseline assessments at the mean age 18 months (*SD*=4.2) and final assessments at 31 months (*SD*=5.7) were administered the Autism Diagnostic Observation Schedule (ADOS) for every 1-6 months. All children initially received the Toddler Module and 58 children transitioned to Module 2 at the average age of 30 months (*SD*=3.53). Symptom trajectories were examined based on Proc Traj using the calibrated severity scores. Changes in NVIQ and VIQ scores as well as each item score on the ADOS Toddler Module were examined using the Generalized Linear Mixed Model (GLMM).
Results: Using the minimum BIC as the selection criterion, the best trajectory typology was a model with four classes (Figure 1; nonspectrum ~ 24%; worsening ~27%; moderately persistent~24%; severely persistent ~25%). Children with ASD were more likely to belong to the worsening, moderately persistent and severely persistent groups (71%, 97% and 97% respectively) than the nonspectrum group (8%), $\chi^2(3)=417.816$, $p<0.001$. Most children who developed phrase speech by age 3 were more likely to belong to the nonspectrum and worsening groups (50%) than the other two groups (17-28%), $\chi^2(3)=228.692$, $p<0.001$. Trajectory groups showed significant differences in baseline ADOS calibrated severity scores (Table 1) (F=46.705, social affect; F=10.287, repetitive behaviors; p's<0.001). At both the baseline and final evaluations, the four groups varied significantly in their NVIQ and VIQ scores (p's<0.001). NVIQ was stable for all groups whereas group by age interaction emerged for VIQ (F=1.423, $p<0.05$) as VIQ improved for the nonspectrum and worsening groups but was stable for the other two groups. At the item level, children showed either an improvement (e.g., frequency of vocalization, use of gestures) or stability (e.g., eye contact, facial expression) on a majority of items although a few symptoms worsened (e.g., response to name).
Conclusions: Trajectories of ASD symptoms were most strongly predicted from initial levels of social communication impairments. Symptom levels for most children within the moderate to severe ranges initially were stable over the first and second year of life. A subset of children with ASD (20%) showed mild symptom levels during the first year, which worsened gradually over time, consistent with the past findings (e.g., Ozonoff et al., 2015). The initially lower symptom level may delay the ASD diagnosis in these children. The severely persistent group showed the most impairment in language and cognitive skills across time. Initially mild symptom levels predicted better language outcomes. More variability in trajectories was observed at the item level, suggesting that item trajectories do not necessarily follow the overall symptom trajectories.

10:50 **176.002** Stability and Change in ASD Symptoms from Childhood to Young Adulthood: Associations with Spoken Language Development

V. Hus Bal[1]*, M. Fok*[2] *and C. Lord*[3]*, (1)STAR Center for ASD & NDD; Dept of Psychiatry, University of California, San Francisco, San Francisco, CA, (2)University of California, San Francisco, San Francisco, CA, (3)Psychiatry, Weill Cornell Medical College, White Plains, NY*

Background: Â Previous studies suggest improvements in autism symptoms across child- and adulthood (McGovern & Sigman, 2005; Gillespie-Lynch et al., 2012). It is unclear, however, if all symptoms are improving or if specific behaviors show different trajectories. Although symptom manifestation is known to vary across language levels (e.g., Dilavore et al., 1992), the extent to which reported "improvements" reflect social-communicative development attributable to improvements in language has not yet been explored.
Objectives: Â To explore trajectories of social-communicative (S-C) symptoms from ages 2 to 18 in children exhibiting different language development patterns.
Methods: Â S-C symptoms of 132 children with ASD referred before 2 years were assessed using the Autism Diagnostic Interview-Revised (ADI-R) at five ages (approximately 2, 3, 5, 9, 18). Ten items from Current Behavior Algorithm S-C domain were summed to yield three subdomains (Nonverbal Behaviors, Shared Enjoyment, Socioemotional Reciprocity) and an overall S-C score. Because most children were language-delayed at 2, the sample was divided by language level at 3 and 18: verbal at 3 and 18 (V-V), delayed at 3/verbal at 18 (D-V), delayed at 3/minimally verbal at 18 (D-MV). Generalized Linear Mixed Models were used to explore trajectories of S-C symptoms; main effects of time and language group and time*language interactions were assessed.
Results: Overall S-C scores decreased across time (Fig1; p<.001). The D-MV group exhibited the most impaired S-C at all ages (p<.001). D-V and V-V differed only at T3 (p<.001). From 2-18, the D-MV group showed less improvement (Mdiff=2.65) than D-V (Mdiff=6.47) and V-V (5.91). Trajectories of Shared Enjoyment and Socioemotional Reciprocity showed similar patterns, with V-V and D-V groups demonstrating the greatest reduction in symptoms. Notably, the V-V group showed significant improvements in Shared Enjoyment from 2-3 and 3-5, whereas Socioemotional symptoms declined the most between 2-3. S-C items provided evidence for improvement, stability and, worsening of individual symptoms (Fig.2). While some items showed improvement across language levels, reduction of most symptoms seemed to be related to language development. Items relating to nonverbal communicative behaviors (inappropriate facial expressions and social smiling) showed stable or worsening trajectories.
Conclusions: Consistent with prior studies, overall social-communicative symptoms declined across childhood. These data suggest, however, that apparent improvements in some symptoms may be attributable to language gains, whereas others show improvement or stability across language levels. These findings underscore the difficulty in separating social and language abilities and the need to consider language skills when interpreting estimates of social-communicative behaviors, particularly in longitudinal or treatment studies monitoring changes over time. It is also important to highlight that ADI-R diagnostic classifications are based upon past behaviors; declines in symptoms (regardless of relation to language) demonstrate why current behaviors cannot be used in place of past symptoms for diagnostic purposes. Finally, differences in symptom presentation by both language and age highlight the need to develop new tools to assess current symptoms, particularly in adults with more developed language. Tools developed for use with younger children may not include items that capture the full manifestation of ASD in adulthood.

11:10 **176.003** Developmental Trajectories from Mid-Childhood to Early Adulthood in a Population Sample

T. Charman[1]*, R. Kent*[2]*, S. Lukito*[3]*, D. Stringer*[4]*, G. Baird*[5]*, A. Pickles*[6] *and E. A. Simonoff*[7]*, (1)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Institute of Psychiatry, Psychology, and Neuroscience, King's College London., London, UNITED KINGDOM, (4)Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, United Kingdom, (5)Newcomen Children's Neurosciences Centre, Evelina London Children's Hospital at Guy's and St Thomas' NHS Foundation Trust, London, UNITED KINGDOM, (6)King's College London, London, UNITED KINGDOM, (7)Institute of Psychiatry, London, UNITED KINGDOM*

Background: An increasing number of studies have examined outcomes from childhood into adulthood in individuals with autism spectrum disorder (ASD). However, most samples have been clinically ascertained and few, if any, population-based.
Objectives: To examine early adult outcomes in the population-based Special Needs and Autism Project (SNAP) cohort (Baird et al., 2006).
Methods: From 158 children with ASD seen in the SNAP prevalence cohort at age 12 years a subsample were re-assessed in adolescence (age ~16 years, *n* = 90, excluding lowest IQ subsample) and young adulthood (age ~23 years, *n*= 126, full IQ range). We collected data on IQ (WISC, WASI), adaptive functioning (Vineland Adaptive Behavior Scale (VABS), Adaptive Behavior Assessment Scale (ABAS)) and mental health problems (Strengths and Difficulties Questionnaire (SDQ)). One-way repeated measures ANOVAs and post-hocs were run to determine if there were differences in scores across time.
Results: There were statistically significant differences over time for IQ, $F(2,146) = 43.4$, $p<0.001$; follow up t-tests found IQ at 23 years to be significantly higher than at 12 years ($p<0.001$) or 16 years ($p<0.001$). General adaptive behaviour composite scores were significantly higher at 23 years as measured using the ABAS than at 12 years as measured using the VABS ($t(110) = 15.28$, $p<0.001$). Total SDQ scores also varied significantly over time $F(2,146) = 31.3$, $p<0.001$; follow up t-tests found total SDQ score at 16 years ($p<0.001$) and 23 years ($p<0.001$) to be significantly lower than at 12 years. We are currently conducting multivariate analyses to examine the following questions: (1) using latent growth models to test the childhood predictors of young adult outcomes; and (2) using latent class analysis (LCA) approaches to examine individual trajectories over time. Finally, we will use a statistical weighting procedure to report estimates weighted back to the epidemiological sample from which the cohort was drawn.
Conclusions: In common with previously reported clinically-ascertained samples followed into adulthood, in the SNAP prevalence sample we found some evidence of improvements over time in intellectual ability and adaptive functioning and a reduction in mental health problems, at least as assessed by the SDQ screener. Some caution is required, in part because of the different measures used to assess IQ and adaptive behaviour over time and the developmental appropriateness of the SDQ in young adults. Adult outcomes in the population of individuals with ASD are highly variable and understanding more about mid-childhood predictors of young adult outcomes may help us clarify appropriate targets for intervention and support.

11:30 **176.004** Autism 30 Years Later: A Follow up Study of Children Diagnosed with ASD from 1970-1999

M. R. Klinger[1]*, N. Bagatell*[2]*, A. T. Meyer*[2]*, W. T. Brooks*[3] *and L. G. Klinger*[1]*, (1)UNC TEACCH Autism Program, Chapel Hill, NC, (2)University of North Carolina at Chapel Hill, Chapel Hill, NC, (3)TEACCH Autism Program, Carrboro, NC*

Background: While there is a developing literature on ASD in adulthood, few longitudinal studies from childhood to adulthood have been conducted. The majority of these studies have focused on the transition years from adolescence to young adulthood. Thus, there is little research on autism in middle adulthood.
Objectives: This research capitalizes on a unique data set of individuals who were diagnosed with ASD as children by the University of North Carolina TEACCH Autism Program from 1970-1999. Participants were reevaluated an average of 30 years after their initial diagnosis in order characterize changes in symptom severity, IQ, and adaptive behavior from childhood to mid-adulthood. Specific objectives included: (1) Measure the stability of ASD characteristics from childhood into middle adulthood; (2) Measure the relative increase or decrease in ASD characteristics from childhood into mid-adulthood.
Methods: Participants were 55 adults with ASD in mid-adulthood (27-57 years of age, M = 37 years) who had previously participated in a larger study of adult outcomes. All adults were diagnosed with an ASD during childhood (initial evaluations at 29 months to 16 years, M=6 years, 4 months). Participants participated in comprehensive assessments in adulthood including diagnostic (ADOS-2 and CARS-2), intellectual functioning (Stanford-Binet-5), and adaptive behavior (VABS-II) assessments. Additionally, childhood assessment data were also used from the CARS, IQ scores from a wide variety of tests, and Vineland Adaptive Behavior Scale (VABS).
Results: 54 out of 55 adults met diagnostic criteria across clinical judgment, CARS-2 and ADOS-2. CARS-2 scores during adulthood were modestly related to childhood CARS scores (r=+.34, p=.01), with little overall change in total CARS score (Childhood M=33.5, Adulthood M=33.1; t(54)=.45, p=.66). Intellectual functioning was remarkably stable across 30 years with adult IQ being strongly correlated to childhood IQ (r=+.71, p<.001). However, IQ scores showed a marginally significant drop over time (Childhood M=71.4, Adulthood M=66.9; t(52)=1.65, p=.10). Adaptive behavior was also quite stable across 30 years with adult VABS-II Standard Scores being strongly correlated to childhood VABS Standard Scores (r=+.52, p<.001). However, these scores showed a substantial decrease over time (Childhood M=61.1, Adulthood M=45.2; t(49)=5.29, p<.001).
Conclusions: In spite of a 30-year delay, ASD diagnoses were stable over time. Of the 55 participants in this study, only 1 did not receive a current ASD diagnosis. ASD symptoms, intellectual functioning, and adaptive behavior during adulthood were highly correlated with scores from childhood. This is especially impressive given the wide variety of IQ tests given during the childhood assessments. Both intellectual functioning and adaptive behavior showed decreased scores in adulthood indicating a decreased rate of development compared to the normative sample. This decrease was especially large for adaptive behavior indicating that adaptive behavior is a crucial area where individuals with ASD are at great risk to fall even further behind their peers as they move into adulthood. These adaptive behavior skills ought to be a primary target for interventions with children and adults with ASD as research suggests that adaptive behavior is the primary predictor of adult employment and quality of life.

Panel Session
177 - Altered Sensory Processing and Social Functioning in ASD: Examining Associations and Mechanisms through Multiple Methods and Populations.
10:30 AM - 12:00 PM - Yerba Buena 9

Panel Chair: Mirella Dapretto, *University of California, Los Angeles, Los Angeles, CA*

Discussant: Kevin Pelphrey, *Yale University, New Haven, CT*

Individuals with ASD have extremely high rates of sensory processing atypicalities, including over-responsivity, under-responsivity, and sensory seeking (Ben-Sasson et al., 2008). However, sensory symptoms have been understudied until recently, when they were added to the DSM-5 diagnostic criteria for ASD. Since then, sensory processing abnormalities have been increasingly recognized to be associated with greater impairment, including more social deficits (Glod et al., 2015). However, there has been little research examining how and why sensory processing difficulties are associated with social impairment. This panel addresses possible mechanisms underlying the association between atypical sensory processing and social symptomatology while highlighting recent advances in behavioral, physiological, and imaging methods for studying sensory processing from infancy through adolescence. Teresa Tavassoli will present data examining whether sensory and social symptoms are differentially associated across children with ASD, Sensory Processing Disorder, and typical development. Blythe Corbett will discuss the association between sensory symptoms, social difficulties, and accumulated stress (as indexed by evening cortisol). Shulamite Green will address neurobiological mechanisms underlying the effect of distracting sensory stimuli on social cognition. Finally, Carissa Cascio will present on sensory seeking and frontal alpha asymmetry as longitudinal predictors of social functioning in infants at high and low risk for ASD.

10:30 **177.001** Exploring the Relationship Between Sensory and Social Symptoms of Autism

T. Tavassoli[1], *L. J. Miller*[2], *S. A. Schoen*[3], *J. Brout*[4], *J. C. Sullivan*[5] *and S. Baron-Cohen*[6], *(1)Seaver Autism Center, New York, NY, (2)STAR Institute for SPD, Greenwood Village, CO, (3)Sensory Processing Disorder Foundation, Greenwood, CO, (4)Duke University Medical Center, Durham, NC, (5)Northeastern University, Boston, MA, (6)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background: Children with autism spectrum conditions (ASC) often show atypical sensory reactivity symptoms in addition to social difficulties compared to typically developing (TD) children. It is unknown, however, whether sensory and social symptoms in ASC might be related to one another. To test this relationship we compared children with ASC to children who exhibit similar sensory symptomatology but do not have ASC, that is, children with the suggested diagnostic term 'sensory processing disorder' (SPD).
Objectives: Â The goals of this study were to determine if a) sensory and social symptoms are related, and b) if children with ASC could be distinguished from children with SPD based on sensory and/or social features. Specifically, we sought to differentiate children with ASC and SPD on sensory subtypes (e.g. over-reactive, under-reactive and sensory craving) and amount of sensory symptoms and/or on social features, specifically empathy using parent questionnaires.
Methods: The study included 210 participants: 68 children with ASC, 79 children with SPD and 63 typically developing (TD) children. We used the Sensory Processing Scale Inventory to measure sensory symptoms (over-reactivity, under-reactivity and sensory craving); the Autism Spectrum Quotient (AQ) to measure autistic traits, and the Empathy Quotient (EQ) to measure social skills.
Results: Children with ASC and SPD showed more sensory symptomatology than TD children (p< .01). Furthermore, even though children with SPD had higher empathy scores compared to children with ASC, they had lower empathy scores compared to TD children (p< .01). Last, sensory symptomatology and social features showed a negative correlation with each other, across groups.
Conclusions: Taken together, our findings suggest that there is a relationship between sensory symptomatology and social aspects of ASC. Children with ASC are most affected by sensory symptoms, and show lowest empathy. Children with SPD lie in between children with ASC and typical developing children on these measures. Future longitudinal studies are needed to explore if children with ASC and SPD both start with the same amount or type of sensory symptoms in early childhood and whether there is a difference in the type of sensory symptoms they display. This study also sheds light on the similarities and differences between children with ASC and SPD. Improved sensory and social phenotyping is an essential first step towards reducing diagnostic confusion between ASC and SPD.

10:50 **177.002** Examining Tactile Sensitivity and Associations with Physiological Arousal and Social Functioning in Youth with Autism Spectrum Disorder.

B. A. Corbett[1] *and R. A. Muscatello*[2]*, (1)Psychiatry and Behavioral Sciences, Vanderbilt University Medical Center, Nashville, TN, (2)Neuroscience Graduate Program, Vanderbilt University, Nashville, TN*

Background: Autism spectrum disorder (ASD) is characterized by significant difficulties in social cognition and communication, as well as impairments in sensory processing. Previous findings have consistently shown elevated evening cortisol in youth with ASD compared to typically developing (TD) peers (Tomarken et al., 2015), suggesting increased accumulation of stress throughout the day (Corbett et al., 2009). Various factors may underlie this increased arousal, to include significant stress from social interaction, changes throughout the days, or heightened sensory sensitivity to internal or external stimuli.
Objectives: The current study examined potential associations between sensory processing, physiological arousal, and social responsiveness in ASD. It was hypothesized that underlying sensory defensiveness would be associated with increased arousal and reduced social functioning in youth ASD.
Methods: A large sample (N=113) of youth with ASD (N=64) or TD (N=49) between 8 and 17 years of age were recruited. Evening cortisol was collected as part of a larger study, which collected diurnal salivary samples over 3 days at home, 4 times per day (Immediate Waking, 30-min post-waking, afternoon, and evening). Sensory sensitivity was reported using the Short Sensory Profile (SSP). Social functioning was assessed by three parent-report measures including the Social Communication Questionnaire (SCQ), Social Responsiveness Scale (SRS), and the Child Behavior Checklist (CBCL). Pearson product correlations were conducted to measure levels of association between dependent variables.
Results: Sensory functioning (SSP) was negatively correlated with evening cortisol at trend-level ($r=-.18$, $p=0.08$). When individual subscales of the SSP were explored, a significant negative correlation was observed for the Tactile domain and evening cortisol ($r=-.28$, $p=0.007$). Moreover, the SSP Tactile domain was also negatively associated with measures of social functioning, including the SCQ ($r=-.64$, $p<0.001$), the SRS total score ($r=-.69$, $p<0.001$), and the social problems subscale on the CBCL ($r=-.69$, $p<0.001$). Within group comparison for the ASD group, corroborated relationships between tactile sensitivity and physiological and social functioning: SSP Tactile showed negative associations with evening cortisol ($r=-.31$, $p=0.03$), SCQ ($r=-.33$, $p=0.02$), SRS ($r=-.43$, $p<0.001$), and social problems on the CBCL ($r=-.61$, $p<0.001$). In the TD group, tactile sensitivity was only correlated with total SRS ($r=-.36$, $p=0.01$).
Conclusions: The study reveals significant associations between evening cortisol, sensory processing, and social functioning. Tactile sensitivity was related to physiological regulation and social responsiveness, such that impaired tactile processing corresponded with elevated evening cortisol and greater impairment in social functioning. Findings suggest sensory processing, especially tactile defensiveness, may underlie a number of symptoms in ASD, including accumulated stress, social responsiveness, and social symptom severity. The lack of significant findings in the TD group further suggest this underlying role of sensory processing may be unique to ASD. Tactile responsiveness may serve as a marker of more significant impairment in other core symptom domains, and future research should be directed towards understanding the directionality of these relationships, such that treating one symptom may directly or indirectly improve the others.

11:10 **177.003** Sensory over-Responsivity and Social Cognition in ASD: Effects of Aversive Sensory Stimuli and Attentional Modulation on Neural Responses to Social Cues

S. A. Green[1]*, L. M. Hernandez*[2]*, H. Bowman*[3]*, S. Y. Bookheimer*[4] *and M. Dapretto*[4]*, (1)Ahmanson-Lovelace Brain Mapping Center, UCLA, Los Angeles, CA, (2)University of California Los Angeles, Los Angeles, CA, (3)NPI Psychiatry, UCLA, Los Angeles, CA, (4)University of California, Los Angeles, Los Angeles, CA*

Background: Sensory over-responsivity (SOR) is an impairing condition manifested as extreme sensitivity to stimuli such as unexpected loud noises or being touched. SOR is particularly common (rates of 56-70%) in autism spectrum disorders (ASD) and, notably, it is associated with higher impairment including greater deficits in social and adaptive behavior (Ben-Sasson et al., 2008). Although SOR is strongly linked to impairment, the mechanisms through which it disrupts social functioning are not well understood. Previous research from our lab suggests that SOR may be related to an overattribution of salience to extraneous sensory information. Individuals with ASD and SOR show hyperactivation and reduced habituation in the amygdala and sensory cortices in response to mildly aversive sensory stimuli (Green et al., 2015), as well as increased salience network connectivity with amygdala and somatosensory cortex (Green et al., 2016). Taken together, these studies suggest that SOR is associated with atypical allocation of attention to extraneous sensory stimuli rather than relevant social stimuli. Yet, the effect of sensory distracters on the brain's ability to process social information has not been tested directly.
Objectives: To examine the effect of a tactile sensory distracter on brain responses during a social cognition task, and to test whether explicitly directing attention to relevant social cues can mitigate the effect of the sensory distracter.
Methods: Participants were 15 children and adolescents with ASD and 16 TD matched controls, between 8-17 years of age. While undergoing fMRI, children completed a social cognition task, which involved determining whether a speaker was sarcastic or sincere. They completed the task with/without a tactile sensory distracter, and with/without instructions directing their attention to relevant social cues. Parents completed the tactile scales of the Short Sensory Profile (Dunn, 1999) and SenSOR Inventory (Schoen et al., 2008); scores were combined into a tactile SOR composite.
Results: When completing the task in the presence of the sensory distracter, TD youth showed increased activity in auditory language and frontal regions whereas ASD youth showed decreased activation in these areas. Instructions mitigated this effect such that ASD youth no longer showed decreased activation during tactile stimulation; instead, the ASD group showed increased medial prefrontal (mPFC) activity. With attentional instructions, higher SOR was associated with greater activity in primary auditory and visual cortex as well as higher-level language and face processing regions, whereas lower SOR was associated with greater activity in temporal pole and mPFC, regions associated with integrative social cognition such as inference and theory of mind.
Conclusions: Results demonstrate for the first time a neural mechanism through which sensory stimuli may disrupt social cognition, and that attentional modulation can restore neural processing of social cues through prefrontal regulation. Attentional modulation may work through different mechanisms depending on level of SOR: youth with high SOR may rely on processing individual visual and auditory stimuli whereas youth with low SOR may be better able to integrate and interpret multiple social cues. Findings have implications for novel, integrative interventions that incorporate attentional directives to target both sensory and social symptoms.

11:30 **177.004** Neurophysiological Substrates and Developmental Sequelae of Sensory Seeking in Infants at High Risk for Autism Spectrum Disorder

T. Woynaroski[1]*, C. Damiano*[2]*, D. M. Simon*[3]*, L. V. Ibanez*[4]*, C. R. Newsom*[5]*, M. Murias*[6]*, M. T. Wallace*[7]*, W. L. Stone*[8] *and* ***C. J. Cascio***[9]*, (1)Hearing and Speech Sciences, Vanderbilt University Medical Center, Thompsons Stn, TN, (2)University of North Carolina, Durham, NC, (3)Program in Neuroscience, Vanderbilt University, Nashville, TN, (4)UW READi Lab, Seattle, WA, (5)Pediatrics, Vandetbilt University Medical Center, Nashville, TN, (6)Duke University, Durham, NC, (7)Vanderbilt University, Nashville, TN, (8)Psychology, University of Washington, Seattle, WA, (9)Vanderbilt University School of Medicine, Nashville, TN*

Background:
Children with autism spectrum disorder (ASD) show a broad range of unusual responses to sensory stimuli and experiences. It has been proposed that early differences in sensory responsiveness may arise from atypical neural function and produce “cascading effects” on development across a number of domains. A primary challenge to confirming these hypotheses is that ASD cannot always be definitely diagnosed in the earliest stages of development (i.e., infancy). A potential solution is to prospectively follow infants at heightened risk for ASD based on their status as infant siblings of children who are diagnosed. The present study examined the developmental sequelae and possible neurophysiological substrates of a specific sensory response pattern: unusually intense interest in nonsocial sensory stimuli or “sensory seeking.” Infants at high risk (HR) for ASD were compared to a control group of infants at relatively lower risk for ASD (LR; siblings of children with typical developmental histories).
Objectives:
Research questions included: a) Do HR infants differ from LR infants in sensory seeking behavior?, b) Does sensory seeking predict concurrent social orienting and future socialization?, and c) Is sensory seeking predicted by early frontal alpha asymmetry?
Methods:
To answer these research questions, we carried out a longitudinal correlational investigation in which 20 HR infants and 20 LR controls were followed over 18 months. At entry to the study, sensory seeking and social orienting were measured in 18-month-old infants using the Sensory Processing Assessment, and alpha asymmetry was measured via resting state EEG. Eighteen months later, social symptomatology was evaluated in a comprehensive diagnostic evaluation.
Results:
HR infants showed elevated sensory seeking relative to LR controls ($t_{(38)}$=2.26, p = .029), and increased sensory seeking predicted reduced social orienting across groups, concurrently (β=.570, t=2.822, p < .0001) at eighteen months. Seeking behavior additionally predicted future social symptomatology across groups (β=.376, t = 2.78, p = .008), but this effect varied by group (seeking*risk group interaction β=.672, t=4.448, p =.008), such that higher seeking at 18 months predicted increased social symptoms in the HR group, but decreased social symptoms in the LR group.Â A mediation analysis indicated that social orienting mediates the relation between sensory seeking and social deficits, and that this effect is moderated by risk group. The relation between frontal asymmetry and sensory seeking at 18 months also varied according to risk group (seeking*risk group interaction β=-2.458, t=-3.38, p = .002), such that increased sensory seeking was associated with greater right asymmetry in the HR group, but with greater left asymmetry in the LR group.
Conclusions:
Findings suggest that sensory seeking may produce cascading effects on social development in infants at heightened risk for ASD by impeding social orienting early in life. Atypical frontal alpha asymmetry may underlie this atypical behavioral pattern of sensory responsiveness.

Poster Session
178 - Early Development (< 48 months)
12:00 PM - 1:40 PM - Golden Gate Ballroom

1 **178.001** Early Social Communication Predictors of Emergent Literacy Skills in Preschool Children with Autism Spectrum Disorder

V. P. Reinhardt[1,2] *and A. M. Wetherby*[2]*, (1)MIND Institute, University of California Davis, Davis, CA, (2)Florida State University Autism Institute, Tallahassee, FL*

Background:
Reading proficiency is pivotal for academic success, with wide ranging societal, educational, and economic costs associated with low literacy attainment (Baer, Kutner, Sabatini, & White, 2009). The core social communication features and associated language difficulties frequently observed in children with Autism Spectrum Disorder (ASD) place them at risk for developing reading difficulties (Ricketts, Jones, Happé, & Charman, 2013). Reading difficulties (RD) are among the most common and persistent areas of learning challenges in students with ASD (Huemer & Mann, 2010; Randi, Newman, & Grigorenko, 2010). Preschool emergent literacy (EL) skills are developmental precursors to school-age literacy and academic skills and provide the means to identify children at risk for RD early. The literature examining EL skills in children with ASD is limited, and few investigations have examined predictors of EL skills.
Objectives:
To examine the relations between early social communication (18-24 months) and preschool emergent literacy skills in a longitudinal sample of children with ASD.
Methods:
Children in the current study (n=45; 38 male) were recruited from the FIRST WORDS®Project (Wetherby et al., 2004), a prospective longitudinal study of children at the Florida State University Autism Institute. Children in the current study completed the Communication and Symbolic Behavior Scales (CSBS) Behavior Sample between 18-24 months (M= 21.45, SD= 1.37) and a comprehensive language and literacy battery around 4-5 years of age (M= 60.34, SD= 4.57). To confirm ASD diagnosis, all children participated in a comprehensive ASD evaluation battery that included the Autism Diagnostic Observation Schedule, Mullen Scales of Early Learning and Vineland Adaptive Behavior Scales and received a best-estimate diagnosis of ASD. EL skills including print knowledge and phonological awareness were measured using the development version of the Test of Preschool Early Literacy (Lonigan, Wagner, Torgesen, & Rashotte, 2007). Oral language was evaluated using the Clinical Evaluation of Language Fundamentals- Preschool (Wiig, Secord & Semel, 1992), Peabody Picture Vocabulary Test-III (Dunn & Dunn, 1997), and the Expressive One-Word Picture Vocabulary Test-Revised (Brownell, 2000). Nonverbal cognitive functioning was measured using three subtests of the Stanford-Binet Intelligence Scale, Fourth Edition (SB-IV; Thorndike, Hagen, & Sattler, 1986).
Results:
Predictive relations between CSBS cluster scores and latent preschool Oral Language, Phonological Awareness, and Print Knowledge variables were examined using multiple regression. Findings indicated moderate, significant relations between the CSBS Emotion and Eye Gaze cluster and preschool oral language (r = 0.49, p = 0.001) and between the CSBS Understanding Cluster and preschool oral language (r = 0.50, p < 0.001). In addition, there was a moderate, significant predictive relation between the CSBS Understanding cluster and preschool phonological awareness (r = 0.31, p< 0.05).
Conclusions:
These findings provide preliminary evidence that early social communication skills in the second year of life may offer a useful strategy to predict later language and reading difficulties. Delineating predictors of EL has important implications for understanding how early social communication deficits impact the development of reading in children with ASD.

2 **178.002** "The Phenomenon of Loss." Early Development and Functional Outcome in Children with Autism Spectrum Disorder and Reported Developmental Regression.

S. D. Boterberg[1]*, R. Van Coster*[2] *and H. Roeyers*[1]*, (1)Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium, (2)Department of Pediatric Neurology & Metabolism, Ghent University Hospital, Ghent, Belgium*

Background: Although in most children with ASD an *early onset* of symptoms can be observed, about one-third appears to show a loss of previously established skills somewhere in the second year of life, a phenomenon called *regression*. Recently, additional patterns of onset have been described such as *early onset+regression* and *plateau*. However, due to methodological issues and different views on the definition of regression, still little is known about early pathways, causes, predictors and prognosis.
Objectives: The first purpose is to explore the trajectories of different onset patterns in ASD. Second, we want to examine if pre-regression development is really typical. Third, outcomes in terms of severity of ASD-symptoms, language and behavioural functioning will be investigated.
Methods: Participants are 100 children (4-10y) with a diagnosis of ASD. Parent report is used to measure early ASD-symptoms, classification to onset groups (EDQ, ADI-R, RSQ) and current behavioural problems (CBCL). Non-verbal intelligence is measured through the WNV. Current severity of ASD-symptoms is both reported by parents (SCQ, SRS) and clinically evaluated (ADOS-2). Outcomes in language reception and production are measured through the CELF-4 and by parent report (NCDI).
Results: Preliminary results based on 54 children revealed an *early onset* (*n*=23), a *later onset* (*n*=15) and an *early onset+regression* group (*n*=6). Other children had a typical development followed by *regression* (*n*=8) or *plateau* (*n*=3). Regression involved in 92% of the children loss of language skills, in most cases combined with loss of other skills such as social skills. In 38% of the children loss or a stagnation in motor skills (mean onset: 18m) was reported to precede loss in other skills (mean onset: 24m).
Analysis of early development shows similar scores of social and stereotyped behaviours in the first 18 months of life in both the regression (ASD-R) and non-regression group (ASD-NR). Further, ASD-R showed even less early communicative behaviours ($U(50)=105.5; p<.01$) and received the clinical diagnosis of ASD at a younger age than ASD-NR (38m vs 67m; $t(52)=4.2; p<.001$).
Analysis of current functioning shows lower non-verbal intelligence scores (67 vs 92; $U(54)=83.5; p<.001$) in ASD-R. Examination of current severity of ASD-symptoms and behavioural problems based on parent report shows no significant differences. However, on the ADOS-2 there are significantly more restricted and repetitive behaviours ($U(54)=486; p<.001$) in ASD-R, especially more sensory interests ($\chi^2(1)=14.6; p<.001$) and mannerisms ($\chi^2(1)=27.6; p<.001$). Analysis of current language outcome shows both an increased delay in receptive and expressive language (37m vs 11m; $t(51)=3.3; p<.01$ and 32m vs. no delay; $t(51)=3.6; p<.01$, respectively) in ASD-R.
Conclusions: We found support for different onset patterns previously described in the literature. Since some parents report motor atypicalities preceding loss of other skills, some evidence is provided for the over-pruning hypothesis as a neuropathological mechanism of regression. Further, the majority of ASD-R appears to have pre-existing social-communicative difficulties and received their clinical diagnosis earlier than ASD-NR, supporting that regression may provide a useful “red flag” in identifying children who are at risk for ASD. Furthermore, ASD-R display more severe impairments later in life as measured by non-verbal IQ, clinical evaluation of ASD-symptomatology and language abilities.

3 **178.003** 'Sticky Attention' and the Development of Impaired Social Orienting and Atypical Arousal Regulation in Infants at High Risk for ASD

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Background: Flexibly shifting attention – disengaging from a current locus and shifting attention to a new object or event within the environment – plays an important role in the development of both social orienting and arousal regulation. In infants at high risk for autism (HRA), slowed attentional disengagement is one of the earliest impairments reported, and is associated with a later diagnosis of the autism spectrum disorder (ASD). Thus, early deficits in disengagement may contribute to the atypical development of social orienting and/or arousal regulation, and play an important role in the emergence of ASD.
Objectives: To investigate the association between attentional disengagement, measured at 6 months, and development of social orienting and arousal modulation, measured at 12, 18, and 24 months, in HRA (with and without a later diagnosis of ASD) and low-risk comparison (LRC) infants.
Methods: Infants completed visits at 6, 12, 18, and 24 months of age. An eye-tracking paradigm was used to assess the speed of attentional disengagement at 6 months (n=35 HRA; n=42 LRC). Latency to disengage attention was measured as the time necessary to shift attention from a central fixation (i.e., a face) to a peripheral target. Social orienting abilities were assessed using three observational measures, the Communication and Symbolic Behavior Scales (CSBS) and the Autism Observation Scales for Infants at 12 months, and the Autism Diagnostic Observation Schedule at 18 and 24 months, as well as the CSBS parent-report questionnaire at 12 and 18 months. Arousal regulation was measured using a series of parent-report questionnaires: the Infant Behavior Questionnaire at 12 months, the Toddler Behavior Assessment Questionnaire at 18 and 24 months, and the Infant Toddler Social Emotional Assessment at 12, 18, and 24 months. Items and subscales from these measures were standardized and averaged to create social orienting and arousal regulation composite scores at 12, 18, and 24 months.
Results: Latency to disengage attention at 6 months did not differ significantly between HRA and LRC groups. For the LRC group, but not the HRA group, faster disengagement latency at 6 months was associated with better social orienting abilities at 12 months, $r(31) = .53$, $p<.01$ (see Figure 1). For the HRA group, but not the LRC group, slower attentional disengagement was related to poorer arousal regulation at 12 months, $r(33) = .59$, $p<.01$, 18 months, $r(28) = .54$, $p<.01$, and 24 months, $r(26) = .47$, $p<.05$.
Conclusions: Efficient attentional disengagement is vital for the adaptive allocation of attention (e.g., sharing attention with a communicative partner) and facilitates early arousal regulation (e.g., shifting attention away from an over-arousing stimulus). Preliminary results suggest that faster attentional disengagement is associated with more skillful social orienting abilities at 12 months in LRC but not HRA infants. In contrast, for the HRA group, increased latency to disengage attention was associated with greater aversion to novelty and difficulties in regulating arousal. Our findings suggest that atypical attentional disengagement may have sequelae that, in combination with other primary disturbances, contribute to the emergence of the ASD phenotype.

4 **178.004** A Results Driven Approach to Evaluating Progress for Toddlers with ASD Participating in a State Early Intervention Program

D. M. Noyes-Grosser[1], *K. M. Siegenthaler*[1], *Y. Wu*[1], *B. Elbaum*[2] *and R. G. Romanczyk*[3], *(1)New York State Department of Health, Bureau of Early Intervention, Albany, NY, (2)University of Miami, Coral Gables, FL, (3)State University of New York at Binghamton, Binghamton, NY*

Background: States must report annually to the U.S. Department of Education on child outcome indicators for toddlers exiting Part C Early Intervention (EI) Programs. Data are aggregated across the heterogeneous group of children in EI for reporting purposes. In New York State, children with ASD represent approximately 11% of children receiving EI. However, outcomes are not reported separately for this group.
Objectives: To evaluate outcomes of Part C EI services, using federal outcome indicators, for toddlers with ASD in New York State's EI Program (NYSEIP).
Methods: Early intervention and preschool special education evaluation records were obtained for 160 children with ASD in the NYSEIP. Trained reviewers completed the Child Outcome Summary (COS) rating (National Early Childhood Outcomes Center, 2005) in three federal outcome areas:Â social emotional development, including positive social relationships; acquisition and use of knowledge and skills, including early language and literacy; and use of appropriate behaviors to meet needs. Ratings within each outcome area were derived from evaluations conducted on entry to EI and exit to preschool special education. Standardized test scores in all developmental areas were used to determine COS ratings, except in a few instances where scores were not available and descriptive developmental information was used instead. Based on entry and exit ratings, children were classified into 3 groups: (a) received the same score at both time points (consistent delay compared to typically developing [TD] peers), (b) had a higher score on exit than on entry (moved closer to TD peers), or (c) had a lower score on exit than on entry (lost ground compared to TD peers).
Results: In the area of social-emotional development, 42% of toddlers with ASD moved closer to TD peers, 25% maintained a consistent delay, and 31% lost ground compared to TD peers. In the area of acquisition and use of knowledge and skills, 55% moved closer to TD peers, 29% maintained a consistent delay, and 16% lost ground. In the area of using appropriate behaviors to meet needs, 23% moved closer to TD peers, 30% maintained a consistent delay, and 48% lost ground compared to TD peers.
Conclusions: Most studies examining the effect of EI on young children with ASD can be characterized as efficacy studies conducted in controlled research environments (Weitlauf et. al.,2014). This study is unique in evaluating outcomes for children with ASD participating in community-based services delivered through a state Part C EI program. The majority of toddlers with ASD participating in the NYSEIP moved closer to the skill level of TD peers in the area of acquisition and use of knowledge and skills (55%). A smaller percentage showed acceleration of skill development in social-emotional development (42%) and using appropriate behavior to meet their needs (23%). These findings are consistent with those from controlled studies, suggesting EI services delivered through state Part C programs are effective in improving outcomes for children with ASD. Examination of service delivery characteristics associated with positive outcomes can inform development of more effective services for toddlers with ASD and their families.

5 **178.005** Are Longitudinal Associations Between Joint Attention and Language Attributable to Nonsocial Attention in Infancy? an Infant Sibling Study

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Background:
Longitudinal associations between joint attention (JA) and language commonly documented among children with and without autism (Brooks & Meltzoff, 2005; Sigman and Ruskin, 1999) are often interpreted as evidence that both JA and language reflect social understanding (Charman et al., 2000). Keehn and colleagues (2013) hypothesized that atypical non-social attention may underlie impaired JA and contribute to language difficulties among autistic children. Positive associations between the duration of non-social attention in infancy and later language have been demonstrated among typically developing (TD) children (Kannass & Oakes, 2008). Longitudinal associations between social attention, JA, and language have also been documented among TD children (Salley et al., 2013).
Objectives:
To investigate if 12-month nonsocial or social attention is associated with 18-month JA and examine if nonsocial attention accounts for associations between JA and language.
Methods:
Participants with (n = 65) or without (n = 41) an autistic sibling were classified as autistic (n = 9), other concerns (n =17), or TD (n = 80) by a clinician at 36 months or later. At 12 and 18 months, RJA and IJA were assessed with the ESCS. Examiners also caught participants' attention and shook two rattles for approximately 15 seconds. The rate of gaze shifts between rattles (nonsocial attention) and the duration of attention to the examiner (social attention) were coded. The MSEL were administered at 18, 24, and 36 months.
Results:
Nonsocial and social attention at 12 and 18 months were not correlated with 18-month IJA or RJA (ps > .07). We ran repeated measures general linear models with raw expressive and receptive language at 18, 24 and 36 months as dependent variables and outcome, 18-month RJA and IJA as predictors. We then added nonsocial and social attention at 12 and then 18-months to each model. IJA, RJA and outcome were associated with overall expressive language (ps< .05). Outcome predicted changes in expressive language (p< .001). When 12-month attention was entered, nonsocial attention (fewer gaze shifts), IJA and outcome were associated with overall expressive language (ps< .05) while RJA and social attention were not (ps> .12). When 18-month attention replaced 12-month attention, only nonsocial attention and outcome were associated with overall expressive language (ps < .01); RJA, IJA, and social attention were unrelated (ps> .12). RJA, IJA and outcome were initially associated with overall receptive language (ps< .02). When 12-month attention was entered, nonsocial attention, IJA, and RJA (ps< .02) were associated with overall receptive language; social attention and outcome were unrelated (p> .06). When 18-month attention was entered, RJA, nonsocial attention and outcome were associated with overall receptive language (ps < .05) while IJA and social attention were not (ps > .06).
Conclusions:
These findings demonstrate that reduced distractibility contributes to commonly observed associations between JA and language among children with and without autism. However, nonsocial attention was unrelated to JA and some associations between JA and language remained apparent when nonsocial attention was accounted for. Nonsocial attention is not a clear precursor for JA but both contribute to language development.

6 **178.006** Atypical Visual Attention in Infants at High Genetic Risk for Autism Spectrum Disorder

D. Reisinger*, A. Brewe, K. Smith, A. Vittes and J. Roberts, Department of Psychology, University of South Carolina, Columbia, SC*

Background: Evidence indicates that developmental changes in visual attention between 6 to 12 months-of-age predict later autism spectrum diagnoses (ASD; Ibanez et al., 2008). Infants with fragile X syndrome (FXS) are at high risk for developing ASD, as are infants with an older sibling diagnosed with ASD (ASIBs). Abnormal attention to objects have been documented as early as two months of age and extending into preschool years in ASIBs (Jones & Klin, 2013). Similar findings have been identified in FXS (Roberts et al., 2012). To date, no groups have investigated how these two high-risk groups differ in their attention to objects. Investigating early deficits in visual attention in infants at high risk for ASD can refine the infant phenotype of FXS and ASIBs and serve as a potential prognostic indicator of ASD risk.
Objectives: Our aim was a cross-syndrome characterization of the relationship of object attention in high risk samples at 9, 12 and 24 months of age and its predictive value to ASD severity at 24 months.
Methods: Participants included infant males with FXS (n=18), ASIBs (n=26), and typically developing infants (TD; n=28) assessed at 9, 12 and 24 months of age. Proportion of time looking at toy keys was the dependent variable (LabTAB; Goldsmith & Rothbart, 1996) with visual attention coded offline (κ=0.85). The Mullen controlled for developmental level, and the Autism Diagnostic Observation Schedule-2 reflected autism severity at the 24-month outcome.
Results: Developmental level was included in all models. ANCOVAs suggest no groups differences at 9 or 12 months of age (*p*s>0.05) in attention to objects. However, at 24 months of age there were group differences ($F(2,54)=3.09$, $p=0.05$, *partial* $\eta^2= 0.10$). TD infants spent more time looking at the object in comparison to ASIBs. Regression models examined object attention predicting later ASD severity. At 9 months, increased object attention was predicative of decreased ASD severity at 24 months in ASIBs (*B*=-11.43, *SE*=2.96, *p*=0.01), but not in FXS (*B*=-11.66, *SE*=5.84, *p*=0.11). At 12 months, increased object attention was associated with increased ASD severity at 24 months in infants with FXS (*B*=20.46, *SE*=8.96, *p*=0.04), but not in ASIBs (*B*=-5.11, *SE*=4.23, *p*=0.25). At 24 months, object attention was not predictive of ASD severity at 24 months in FXS (*B*=2.75, *SE*=3.86, *p*=0.49) or ASIBs (*B*=5.42, *SE*=3.02, *p*=0.09).
Conclusions: Our results suggest infants with FXS, ASIBs, and TD infants display similar profiles in their attention to objects during the first two years of life, with differences emerging at 24 months of age between infant ASIBs and TD infants. Object attention appears to be related to ASD outcomes differentially in these two high-risk groups. Decreased object attention in ASIBs at 9 months was associated with increased ASD symptoms, whereas increased object attention at 12 months in FXS was related to increased ASD symptoms. These findings suggest that, although object attention may manifest differently in these two groups, they both are associated with ASD outcomes. It appears different mechanisms specific to these two phenotypes impacting object attention may produce similar outcomes relative to ASD.

7 **178.007** Birth Order and Sibling Status Impacts Psychometrics of M-CHAT-R with Follow-up (M-CHAT-R/F)

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Background:
The M-CHAT-R/F is a parent-completed, screening instrument to detect autism spectrum disorder (ASD) in toddlers. When a child screens positive on the initial items, the structured follow-up interview confirms responses and reduces false positives. The presence of older siblings as a comparison can impact parent's perception of development in later-born children. Previous research suggests that parents report developmental concerns about their first-born child significantly later than concerns about later-born children. Furthermore, concerns for later-born children are reported even earlier when there are older ASD-affected siblings. The current study proposes to explore how birth order (first-born vs. later-born) and sibling status (ASD-Sibs vs. NonASD-Sibs) affect performance on the M-CHAT-R/F.
Objectives:
To compare M-CHAT-R/F performance in first-born children (No-Sibs) and later-born children with an older sibling with ASD (ASD-Sibs) or an older sibling without ASD (NonASD-Sibs).
Methods:
Toddlers (*n*=321; *M* = 21.4 mos, *SD* = 3.6) were evaluated after screening positive on the 2-stage M-CHAT-R/F. Diagnostic outcome (ASD vs. non-ASD) was compared across groups using chi square. In a subset of children who received an ASD diagnosis (*n*=126), total scores and item performance at initial and follow-up screen were compared for first-born children (*n*=50) and two groups of later-born children (ASD-Sibs, *n*=30; NonASD-Sibs, *n* = 46). ASD severity, measured by CARS total scores and ADOS severity scores, was compared across groups using one-way ANOVA.
Results:
Samples did not differ on most demographic variables, although the ASD-Sibs group included fewer minority children than the other groups. Findings held when the confound of race was removed from the model. Children in the ASD-Sibs group were more likely to be diagnosed with ASD ($PPV_{ASD\text{-}Sibs}$ = .64; $PPV_{No\text{-}Sibs}$= .55; $PPV_{NonASD\text{-}Sibs}$ = .35, p = .001). In the subset of children with ASD, initial screener scores did not differ between groups ($F(2,123) = 1.396$, p = .251); however, scores after follow-up differed significantly ($F(2,123) = 3.684$, p = .028). Post-hoc comparisons using the Tukey HSD test indicated that the No-Sibs group (*M*=4.47, *SD*=2.89) scored significantly lower after follow-up compared to the ASD-Sibs group (*M*=6.73, *SD*=3.01), whereas the NonASD-Sibs group's (*M*=5.8, *SD*=3.72) scores did not differ from either group. Failed items that were more likely to change to pass with further questioning represented subtle social developmental milestones (e.g., showing to share, following gaze, social referencing) as determined by chi square (*p*'s<.02). No differences were observed between groups on CARS scores and ADOS calibrated severity scores (*p*'s >.5).
Conclusions:
Birth order may impact parents' responses on screening measures, such as the M-CHAT-R, particularly when an ASD-affected child is in the household. Parents of first-born children are more likely to change their responses at follow-up, suggesting a decreased awareness of subtle developmental milestones, especially compared to parents of ASD-Sibs. Diminished change between screener and follow-up for the ASD-Sibs group may suggest accurate reporting, although hypervigilance might also play a role. As ASD severity was comparable across groups, these findings are likely representative of differences in parent experience as opposed to differences in ASD symptomatology.

8 **178.008** Bridging Early Diagnosis and Intervention: Racial Differences in Accessing Early Intervention

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Background: It is important to facilitate the transition to treatment after an early diagnosis of ASD. Delays entering Early Intervention (EI) may occur for many reasons, including how parents perceive the diagnosis (Abrams & Goodman, 1998) and coordination of intervention services (Bailey et al., 2004). Minority families may have additional barriers to access ASD-specific EI. Research indicates that racial minorities, lower income families, and parents with less education report more difficulty entering EI services than families that are more affluent, educated, or those that do not identify as a racial minority (Carr et al., 2015; Zwaigenbaum, 2015).
Objectives: This exploratory study investigated racial differences in accessing EI services following toddler diagnosis of ASD or other developmental delays.
Methods: Parents were recruited as part of a feasibility study of the transitional period following a diagnosis of ASD (*n*=13), Global Developmental Delay (*n*=14), or language disorder (*n*=9). Thirty-six mothers of toddlers (M_{age} =22.72 months *SD*=3.70) were contacted approximately 12 weeks following diagnosis (*M*=87.28 days, *Median*=78.50 days, *SD*=27.56). Majority (*n*=14non-Hispanic Caucasian) and Minority mothers (*n*=21 African American, 1 Latino) answered open-ended questions about accessing EI services. Responses were coded on a continuous scale (0 = "I have not contacted EI services", 4 = "My child is currently receiving therapy." "Child is receiving *more* than 10 hours of services per week."). Two coders reliably rated responses (*Kappa* =.89, *p*<.001).
Results: Majority mothers (M_{EIcode}=2.93, SD=.27; e.g., "My child is receiving therapy") were further along in the EI process than minority mothers (M_{EIcode}=1.91, SD=1.27; eg., "I have contacted several providers/I am on the waitlist to receive services"), *r*(35)=-.46, *p*=.01. Race (*β*=-..42, *p*=.01) predicted access to EI above and beyond maternal education, R^2 =.22, *F*(2, 35)=4.53 *p*=.02. Total hours of therapy between majority (*M*=1.39, *SD*=.1.42 and minority children did not differ significantly (*M*=.89 *SD*=1.44) *t*(34)=.04, *p*=.84, *d*=.35, small effect, range 0-6 hours). There was not a significant main effect of diagnosis on access to EI and there were no significant race x diagnosis interactions.
Conclusions: Parental race significantly predicted access to EI three months after receiving a diagnosis, even after accounting for maternal education. Minority mothers (predominantly African American) were less likely to be as far along in the EI process as majority mothers at follow-up. On average, minority mothers had contacted several EI providers but were not yet receiving therapy, whereas majority mothers already accessed therapy at follow-up. Although the number of therapy hours did not significantly differ between majority and minority toddlers, a similar trend is observed with minority mothers reporting fewer therapeutic hours. Additionally, toddlers within this sample are only receiving approximately one hour of therapy (*M*=1.08, *SD*=1.43) per week, far less than what is recommended. Given the low number of total EI hours across both groups, all families may benefit from additional support in accessing necessary EI services. Systemic improvements may be necessary to improve the availability and accessibility of EI services for families, immediately following diagnosis.

9 **178.009** Can Early Vocalizations Predict Later ASD Symptom Severity?

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Background:
Varied infant risk markers predict later diagnoses of autism spectrum disorder (ASD). Limited findings are available, however, on predicting continuous measures of ASD symptoms from behaviors of infants at-risk for ASD (Macari et al., 2012; Northrup & Iverson, 2015). This approach is consistent with the current conceptualization of ASD as a dimensional disorder (Lord & Jones, 2012), and clinically important because of the possibility that infants at highest risk for severe ASD symptoms (and most in need of early intervention) can be identified earlier than reliable diagnoses can be made. Pursuing this idea, we examined the utility of one infant ASD risk marker, a low frequency of vocalizations directed to others (Ozonoff et al., 2010; Winder et al., 2013), in predicting later ASD symptom severity.
Objectives:
To investigate to what extent infant vocalizations (directed/non-directed) predict later ASD symptom severity in social-affective (SA) and repetitive and restricted behaviors and interests (RRBI) domains among community-identified infants at-risk for ASD.
Methods:
Our sample comprised 82 infants, identified as at-risk for ASD via community screening with the First Year Inventory (Baranek et al., 2007). Thirty-minute video samples were coded for directed and non-directed speech-like vocalizations at 14 months (range 13-15). "Directed" vocalizations were those accompanied with gestures and/or eye contact, used within an interactive context, or imitating an adult's vocalization. We used the frequency of directed and non-directed vocalizations to predict the severity of SA and RRBI symptoms at 23 months (range 20-25), based on the calibrated severity scores derived from Autism Diagnostic Observation Schedule-2 algorithm scores (Hus et al., 2014).
Results:
First order correlations showed a non-significant negative correlation between directed vocalizations and SA severity, *r* = -.143, *p* =.199, and a significant negative correlation with RRBI severity, *r* = -.421, *p* < .001).Â In contrast, non-directed vocalizations correlated significantly and positively with SA (*r* = .287, *p* = .009), but minimally and non-significantly with RRBI (*r* = .092, *p* = .412). Despite patterns in the first order correlations, multiple regression analysis showed that both directed (*β* =-.478, *t*(80) =-4.65, *p* < .001) and non-directed (*β* =.217, *t*(80) = 2.11, *p* =.038) vocalizations contributed significantly to predicting RRBI at 23 months, accounting for 22.1% of the variance in RRBI severity. Similarly, both directed (β = -.235, t(80) = -2.16, p =.034) and non-directed vocalizations (*β* = .348, *t*(80) = 3.21, *p* =.002) made significant contributions to accounting for a total of 13.4% of the variance in SA severity.
Conclusions:
The finding that directed and non-directed vocalizations combined to account for more variance in later RRBI severity than SA severity was partially inconsistent with our predictions, especially given the relatively strong role for directed vocalizations in predicting RRBI severity. Nevertheless, particularly if combined with other infant risk markers, vocalizations may have utility in identifying infants whose functioning will be most severely impacted by ASD. Future research should be directed at explaining the associations between directed/non-directed vocalizations and RRBI and SA severity.

10 **178.010** Cascading Effects of Attention Disengagement and Sensory Seeking on Social Symptoms in a Community Sample of Infants at-Risk for a Future Diagnosis of ASD

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Background: Sensory seeking behaviors are prevalent across development in children with ASD and are associated with greater autism severity and lower social adaptive skills (Ausderau et al., 2016; Watson et al., 2010). These features are also correlated with attention disengagement difficulties (Sabatos-Devito et al., 2016). Preliminary work with infants at familial risk for ASD (i.e., infants sibs) suggests that sensory seeking may predict later social symptomatology, mediated through reduced social orienting (Woynaroski et al., under review).
Objectives: We aimed to systematically replicate and extend earlier findings, drawing on extant longitudinal data from a *community sample* of one year-olds at-risk for a later diagnosis of ASD.
Our specific research questions were (1) Is increased sensory seeking late in the second year of life (i.e., 20-24 months) related to social symptom severity at 3-5 years of age, via social orienting? (2) Is increased sensory seeking *as measured earlier in the second year of life* (i.e., 13-15 months) similarly predictive and mediated by social orienting?
Methods: 55 infants were identified at 12 months of age using the two-domain cut-off on the First Year Inventory (Turner-Brown et al., 2013) as part of recruitment into an intervention study, and assessed at three time points (T1: 13-15 mos.; T2: 20-24 mos.; T3: 3-5 yrs.). Intervention and control groups were merged for these analyses since no main effects of treatment on child outcomes were found in the parent study. Two mediation models were conducted testing the extent to which observed sensory seeking behavior, tested at T1 & T2 using the Sensory Processing Assessment (SPA; Baranek, 1999), predicted ADOS social-affective calibrated severity scores (T3), mediated through social orienting, which was also measured using the SPA (T2). Post-hoc analyses investigated attention disengagement as a precursor of seeking behaviors in early development.
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Results: We replicated findings that a) high-risk children who go on to be diagnosed with ASD show heightened sensory seeking in the 2nd year of life relative to those who do not receive a diagnosis, and b) increased sensory seeking indirectly related to later social symptomatology via reduced social orienting. Sensory seeking appears to have more clinical utility later in the second year of life (20-24 mos.) than earlier (13-15 mos.) in the present sample. Post hoc analyses suggested diminished attention disengagement at 12-15 mos. preceded and predicted increased sensory seeking at 20-24 mos.
Conclusions: Findings added support for the notion that sensory features produce cascading effects on social development in infants at risk for ASD and suggest that reduced attention disengagement early in life may set off this cascade.

11 **178.011** Characterization of Infants at High-Risk and Ultra High-Risk for Autism

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Background: Converging evidence suggests that there are multiple genetic pathways to autism spectrum disorder (ASD). One genetically high-risk group that has been studied widely includes infants with older siblings with ASD, with risk modulated by the number of affected individuals in a family (multiple affected: multiplex, one affected: simplex). These younger siblings (*high-risk [HR] siblings*) have a recurrence rate of 18.7%, whereas siblings from multiplex families (i.e., *ultra high-risk [UHR] siblings*) carry an additional twofold increase in risk. While it is expected that a larger proportion of UHR siblings will present with atypical development by age three, the timing and quality of the divergence in development between UHR and HR siblings is unclear. Investigation of UHR siblings offers a unique opportunity to determine whether there are observable differences in early development associated with a heightened genetic load for ASD.
Objectives: To contrast cognitive abilities, language skills, and early autism symptoms in UHR and HR siblings from ages 6-18 months.
Methods: Participants included 25 HR and 9 UHR siblings enrolled in a longitudinal study. HR siblings had one older sibling with ASD (no other family history) and UHR siblings had at least two older siblings with ASD. *Cognitive abilities* were measured by the Mullen Scales of Early Learning (MSEL) at 6, 12, and 18 months. *Language skills* were measured with the MacArthur Communication Development Inventory (CDI; parent report) at 9, 12, and 18 months. Early *ASD symptoms* were measured by the Autism Observation Scale for Infants (AOSI) at 12 months and Autism Diagnostic Observation Schedule-Toddler Module (ADOS-T) at 18 months.
Results: Initial results (see Table 1) indicate no apparent differences in cognitive and language abilities between HR and UHR siblings prior to one year, nor were there differences in gross motor skills at any age. However, differences were observed in cognitive abilities at 12 and 18 months. Group differences were most prominent in the MSEL nonverbal domains at 12 months, while global cognitive delays, particularly in language, characterized the UHR siblings' MSEL performance at 18 months. Differences in language skills were also reported by parents on the CDI, most notably in the number of words produced at 12 and 18 months. There were no differences in early autism symptoms at 12 or 18 months.
Conclusions: This study found clinically significant differences in cognitive and language abilities between HR and UHR siblings emerging by 12 months. Children from multiplex families had lower cognitive scores, with a higher incidence of scores indicating developmental delays at 18 months. Although preliminary, results suggest that the impact of increased genetic load associated with multiplex family status may first become evident in general developmental delays, rather than early ASD symptomatology. This may reflect an increased incidence of inherited risk variants in UHR siblings that, while increasing disease burden, may also be less specific to ASD. Given the high incidence of developmental delays, UHR siblings should be monitored closely to assess the need for early intervention. Longitudinal data will continue to be collected in this sample.

12 **178.012** Characterizing Head Motion in Diffusion Magnetic Resonance Imaging (MRI) of Infants in the First Six Months of Life

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Background:
Diffusion MRI (dMRI) is a powerful and noninvasive tool for quantifying the development of brain white matter, potentially playing a critical role in understanding normal brain development and the neuropathology of related brain disorders, such as Autism Spectrum Disorders (ASD). However, the technique is susceptible to head movement as it essentially measures the movement of water molecules in the brain. Although head motion in infants is commonly considered to be more extensive than in adults, patterns of infant head motion, especially in the first six months of life and in dMRI data, have never been systematically characterized.
Objectives:
To systematically characterize head movement in infants from birth to 6 months of age and its impact on dMRI data.
Methods:
27 typically developing (TD) infants (corrected gestational age: 22-195 days, 7 females) were enrolled in the study. A group of 13 healthy adults (age: 23-42 years, 7 females) were also included as a comparison group. All data were collected on a Siemens 3T Tim Trio scanner with 32-channel head coil and multiband sequences. DTI parameters are: TR/TE of 6200/74ms, a multiband factor of 2 combined with a GRAPPA of 2, FOV of 184×184, spatial resolution of 2mm isotropic, b=0/700 s/mm^2, 61 diffusion directions, extra 6 of b0s in both phase encoding directions. FSL and in-house Matlab codes were used to preprocess all MRI data. The output of FSL/mcflirt with 6DOF and mutual information as cost function was used to derive the alignment parameters and motion indices. We also modified a comprehensive measure of head motion, Total Motion Index (TMI), to objectively define signal drop out in developing brains.
Results:
Means of the modified TMI, Framewise displacement (FD), and motion RMS were all higher for infants compared to adults (p=0.003, p< 0.001 and p=0.024, two samples T-test). There was an inverse correlation between motion indices and age in infants. Consistent with studies of older populations, fractional anisotropy (FA) decreased with head motion (p=0.011). We tested several postprocessing techniques to minimize the impact of motion on estimating FA and selected 'eddy' in FSL (5.0.9) because it assumes no models in recovering signal dropout and rotates diffusion gradient table due to head motion. After motion correction, the slope characterizing the relationship between FA changes and age decreased from 0.87 to 0.84,Â suggesting that FA in younger infants may be more corrupted by higher levels of head motion.
Conclusions:
Head motion in 0- to 6-month-old infants was systematically investigated and characterized. In addition, an improved, comprehensive measure of infant motion that quantifies unbiased signal dropout in diffusion MRI was developed. Given the prevalence of head motion in pediatric and clinical populations, a thorough understanding of the impact of head motion on infant neuroimaging data may serve as a critical step in the use of the tool for identifying the neuropathology of ASD.

13 **178.013** Community Screening at 12 Months with the First Year Inventory: Stability of Diagnostic Clinical Impressions over Time

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Background: Research on emergence of autism (ASD) symptoms and stability of diagnosis in very young children has focused primarily on children at high-genetic-risk for ASD (Ozonoff, et al., 2015). The current study follows up a community sample of children identified as at-risk for ASD on the First Year Inventory (FYI) at age 12 months. Previous research found that approximately 31% of children who screened positive on the FYI at 12 months met diagnostic criteria for ASD at age 3 years (Turner-Brown et al., 2013). However, no research has examined whether a diagnosis would be reliable or stable under 18 months in community screened samples. A subsample of children returned for follow-up diagnostic evaluations between 3 and 5 years.
Objectives: Our aim was to examine stability of clinical impressions of the at-risk children at 13 months (mean age = 13.2 months, s.d. = 2.5) with diagnosis established at 4 years (mean age = 47.4 months, s.d. = 7.4), and to examine characteristics at 13 months that distinguished children who were diagnosed with ASD from those that were not. We also aimed to examine clinician confidence about clinical impressions at 13 months.
Methods: Participants in this study represent a subsample of 87 children who screened positive on the FYI and participated in a 6-month RCT of Adapted Responsive Teaching intervention; this subsample (n = 32) participated in a follow-up study with independent raters at age 4 years. At 13 months, participants completed comprehensive evaluations with skilled clinical examiners that included assessment of developmental skills (Mullen Scales of Early Learning) and ASD symptoms (Autism Observation Scale for Infants). Assessors rated their clinical impression of the child (e.g., ASD/not ASD) and their confidence in this rating (Not at all confident (1) to Very Confident (5)). Diagnoses were not made at 13 months, though concerns were shared with families. At follow-up, a comprehensive diagnostic evaluation was completed.
Results: At 4-year outcome, 11 children (34%) were diagnosed with ASD, and 21 (66%) did not meet diagnostic criteria for ASD. Sensitivity (.73), specificity (.81), and positive predictive value (.67) of 13 month clinical impressions with diagnostic outcomes are presented in Table 1. Examiners expressed low confidence in their clinical impressions at 13 months (M=1.9, s.d. = .94) regardless of whether their impression was ASD or not. There were no significant differences in confidence for children whose impression was stable over time compared to those that changed (e.g., false positive/negative), p = .5. Furthermore, there were no significant differences between outcome groups in 13 month AOSI scores, p = .7. On the Mullen at 13 months, children with an outcome diagnosis of ASD had lower expressive language than those who did not develop ASD, t(30) = 2.7, p= .01.
Conclusions: Stability of clinical impressions was lower from 13 months to 4 years than prior research with older children (e.g., 18 -35 months). Clinician confidence was low at 13 months regardless of whether the impression was stable over time. Implications for very early ASD screening will be discussed.

14 **178.014** Comparison of Mullen Profiles Among Children with DS, ASD, and Comorbid Presentation of DS and ASD

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Background: While there is a sizeable body of research on developmental profiles for children with Down syndrome (DS) and children with Autism Spectrum Disorder (ASD), little is known about the profile of children with both (DS+ASD). Although some studies have reported that children with comorbid DS+ASD have lower developmental quotients than those with DS (DiGuiseppi et al., 2010), the profile of relative strengths and weaknesses on developmental tests, such as the Mullen Scales of Early Learning (MSEL), is not firmly established, particularly relative to groups with DS or ASD in isolation. As early intervention has been shown to alter developmental trajectories and improve lifetime outcomes for children with ASD (Orinstein et al., 2014; Zwaigenbaum et al., 2015), elucidating the cognitive profiles of children with comorbid DS+ASD early in development is critical to informing early intervention for this group.
Objectives: The goal of this study is to assess developmental profiles within and between clinical samples of children with ASD, DS, and DS+ASD.
Methods: Participants included 165 children (112 males; Mean age=51.54+23) with ASD (n=111), DS (n=31), and DS+ASD (n=23). Data were compiled from a larger study completed at the University of Colorado School of Medicine (DiGuiseppi et al., 2010) and from the National Database for Autism Research. Children with ASD were matched to the two DS groups on age and sex. Developmental functioning was assessed using the MSEL. Developmental quotients ([mental age/chronological age]*100) were calculated for the Visual Reception (VR), Fine Motor (FM), Receptive Language (RL), and Expressive Language (EL) scales of the MSEL.
Results: A 3x4 repeated measures ANOVA with one between-subjects factor (Group: ASD vs. DS vs. DAS+ASD) and one within-subjects factor (MSEL Scale) was completed to evaluate whether the profile of scores differed as a function of group. A significant group x scale interaction was revealed (F [6,486]=5.7, p<.001), such that the ASD groups had a more variable MSEL scale profile than the DS only group. Specifically, when each group's individual scale DQs were compared to mean DQ (averaged across the 4 scales), a pattern emerged differentiating the DS only group from the two ASD groups. For DS only, VR was significantly higher than mean DQ, while EL was significantly lower (ps<.003).Â In contrast, all scales differed from mean DQ in the ASD and DS+ASD group (all ps<.02); VR and FM were significantly higher, while RL and EL were significantly lower.
Conclusions: Â Results of this preliminary study suggest MSEL profiles for children with DS+ASD are more similar to those with ASD than DS.Â While MSEL absolute scores differed between DS+ASD and ASD overall, the pattern of scores was similar. Moreover, individual scale scores were more variable for the two ASD groups than for the DS group alone. Thus, identifying a comorbid ASD diagnosis in youth with DS appears to not only be important for treatment targeting social-communication skills but also for educational planning.

15 **178.015** Comparison of Parent Report and Direct Assessment of Child Ability in Toddlers

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Background: Parents observe child skills across settings and functional domains. Therefore, parent report may play a key role in the identification of developmental delays. However, recent research has raised concerns about the accuracy of parent report.
Objectives: The current study assessed agreement on receptive language (RL), expressive language (EL), and fine motor (FM) skills, as measured by parent report and direct assessment, in toddlers.
Methods: Participants were 109 children (66 males; mean age 24.0 ± 4.6 months) recruited through a larger study on the early detection of autism spectrum disorder (ASD). Children were divided into three groups (ASD, *n* = 28; Other Developmental Delay (DD), *n* = 57; Typical Development (TD), *n* = 24) according to DSM-IV-TR clinical best estimate diagnosis, using observation, history, and testing data, including Autism Diagnostic Observation Schedule (ADOS) scores. Parent report was obtained using the Vineland Adaptive Behavior Scales, Second Edition (VABS-II). Child ability was directly measured using the Mullen Scales of Early Learning (MSEL). The current study used correlation and mixed-design ANOVAs, with method as a within-subjects factor and diagnostic group as a between-subjects factor, to assess agreement.
Results: Â RL scores on the VABS-II and MSEL were strongly correlated in the DD group ($r(57) = .702$, $p < .001$) and moderately correlated in the ASD ($r(28) = .525$, $p = .004$) and TD ($r(24) = .404$, $p = .05$) groups. On ANOVA, a main effect of method was not significant ($F(1, 106) = .765$, $p = .384$, $\eta_p^2 = .007$). EL scores were strongly correlated in the DD ($r(57) = .675$, $p < .001$) and TD ($r(24) = .732$, $p < .001$) groups, but were not significantly correlated for children in the ASD group ($r(28) = .232$, $p = .418$). On ANOVA, a main effect of method was not significant ($F(1, 106) = .067$, $p = .796$, $\eta_p^2 = .001$). FM scores were strongly correlated in the TD group ($r(24) = .693$, $p < .001$) and moderately correlated in the ASD ($r(28) = .491$, $p = .008$) and DD ($r(57) = .555$, $p < .001$) groups. On ANOVA, a main effect of method trended toward significance, with parents reporting slightly higher FM abilities than seen on direct assessment ($F(1, 106) = 3.880$, $p = .051$, $\eta_p^2 = .035$).
Conclusions: Â Overall, parent report of child ability level did not differ significantly from direct assessment, across functional domains and diagnostic groups. Although ASD group EL scores were not significantly correlated, no effect of method was found on ANOVA; this may be due to limited EL abilities in the ASD group. A trend-level effect of method was found for FM scores, possibly due to child unwillingness to perform tasks on direct assessment or inaccurate parent reporting. Taken together, results suggest that parents are reliable reporters of child ability in toddlerhood, but, given moderate correlations between reported and measured behaviors, the fullest picture may be obtained by using both methods. Future research should examine specific skills that are under- or over-reported.

16 **178.016** Construct and Predictive Validity of Modified Checklist for Autism in Toddlers, Revised with Follow-up (M-CHAT-R/F) Taiwan Version for Toddlers in Taiwan

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Background: Â Identification of ASD at an earliest age allows for provision of early intervention to facilitate the development of affected children. The M-CHAT-R/F is one of the screening tools which refers to the widespread screening of a population at risk for ASD and can be administered to all children in primary care settings. The M-CHAT-R/F is designed as a two-stage screener that consists of parent-report items and clinician-initiated follow-up questions. Our research group has translated the M-CHAT-R/F to Mandarin Chinese as a Taiwan Version. Preliminary results showed that the M-CHAT-R/F Taiwan version had acceptable reliability and discriminative validity for developmental screening in Taiwanese toddlers. However, no previous factor analysis of the M-CHAT-R/F has yet been published in the literature and little is known about the predictive validity for child's developmental outcome.
Objectives: Â The objectives are to 1) explore the factor structure of the M-CHAT-R/F Taiwan version, and to 2) examine predictive validity of the M-CHAT-R/F total score on developmental scores of theÂ MullenÂ ScalesÂ ofÂ EarlyÂ LearningÂ (MSEL)Â at child's 30 and 36 months of age.
Methods: Â Toddlers aged 16-30 months were prospectively enrolled in this study. Children with major sensory, motor or neurological impairment/disorder were excluded. Parents filled out the M-CHAT-R/F at the beginning of the study and received developmental assessments by using the MSEL when child approached 30 and 36 months of age. Exploratory Factor Analysis (EFA) was conducted to investigate the factor structure of the M-CHAT-R/F Taiwan version. Linear regression analysis was used to examine the association between the M-CHAT-R/F total scores and MSEL developmental scores.
Results: Â One hundreds and seven toddlers were recruited in this study. An Initial analysis showed the Kaiser-Meyer-Olkin statistic was 0.87 (above the threshold of 0.5) and the Bartlett's Test of Sphericity was significant ($p < .0001$), indicating that the M-CHAT-R/F data were suitable for EFA. Five factors were derived accounting for 55.6% of the variance (Figure 1): (1) social attention and play (9 items); (2) communication (3 items); (3) interest and imitation (3 items); (4) behavior (3 items); and (5) motor (2 items). All the factor loadings of each item were > 0.3 on the derived factors (ranging 0.45 – 0.84). The results of predictive validity showed the M-CHAT-R/F total scores at child's early ages were significantly associated with the MSEL scores at child's 30 and 36 months of ages (β= 112.9, R^2=0.209, $p<0.001$). Children who were classified as high risk or median risk for ASD in the M-CHAT-R/F scores were found to have significantly lower MSEL developmental scores at 30 and 36 months of age ($p<0.05$).
Conclusions: Â This study showed a five-factor structure for the M-CHAT-R/F Taiwan Version. The finding of factor structure reflects the DSM-5's diagnostic criteria for ASD, providing some evidence towards a similar factor structure of autistic traits and related symptoms for toddlers in Taiwan. Furthermore,Â the associations between the M-CHAT-R/F and MSEL suggests an acceptable predictive validity that the M-CHAT-R/F is predictive of child's developmental outcome on the MSEL scales.

17 **178.017** Decision Factors in Referrals for Autism Spectrum Disorder Evaluations

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Background: Children with autism spectrum disorder (ASD) have better outcomes with early identification and early intervention. Early screening and diagnosis can help identify children with ASD. Professionals have the responsibility to refer children, of any age, for early identification in the presence of concerns or positive screening results. Currently, however, less than half of children with ASD received their first comprehensive evaluation by a professional before age 3, which is late, given the stability of diagnoses at age 2. If signs are evident in many children at age 2, it is unknown why more children are not referred at earlier ages.
Objectives: This study looked at the factors that professionals may use in order to make referral decisions.
Methods: Over 360 interdisciplinary clinicians and educators attended a professional development workshop, where they watched brief clips of children with typical development, language delays, or ASD. Professions included in the sample were health care, speech language and hearing, early intervention, educators, therapists and family service professionals. Professionals were also asked to make a decision about referral, as well as state the factors they used to make this decision.
Results: Â The most commonly used factors to make referral decisions were interactions/engagement, verbal/non-verbal cutes, and appropriate play. Across disciplines, referral accuracy was consistent (75%). A Chi-square test showed no significant effect of profession on accuracy of referral decision (χ^2=0.719). A more detailed analysis of the Chi-square residuals for the collapsed professional categories revealed that speech and hearing professionals were less likely to refer children for autism evaluations in our sample. All other professions showed similar and higher rates of referral. The sensitivity and specificity in referral decisions for this group of professionals was fairly well balanced at .74 and .75 respectively. In our sample, although professionals were accurate in their referrals for a majority of children, they still missed 26% of children with subtle early signs.
Conclusions: Â This result is encouraging, because it tells us that the broad range of disciplines represented in "frontline" early childhood personnel can notice early signs of autism and refer for further evaluation equally, but that this method alone is not foolproof and that referrals are not happening at the same level as shown in this demonstration, suggesting further exploration into factors affecting actual referrals and follow through. These findings also support the need for adding universal screening for autism to detect early signs that might be missed in brief observations.

18 **178.018** Describing a Methodology for Evaluating Robot-Assisted Intervention Using Eye-Tracking

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Background: Robots, similar to other new forms of interactive technology, are used in clinical intervention for children with ASD at an increasing rate (Cabibihan et al. 2013; Diehl et al., 2012; Scassellati et al., 2012). However, understanding effective components of child response to robot-assisted intervention (RAI) is largely unknown aside from initial reports of engagement and interest in robots as a novel technology (e.g., Begum et al., 2016). The majority of published research provides little quantitative assessment (e.g., eye-tracking for visual attention assessment) or experimental manipulation that could establish a strong foundation for using robots in early intervention (Coeckelbergh et al., 2015).
Objectives: The purpose of the current study is to describe methodology for evaluating the utility of RAI for young children with ASD using eye-tracking metrics as a primary measure of attention and response to instruction. The primary aim is to describe how to identify relevant factors for treatment effectiveness based on visual attention to instructional targets of imitative motor actions and verbal fill-in statements. Understanding targeted attentional factors related to viewing RAI will guide design and selection of effective technology-facilitated EI strategies.
Methods: A task analysis for assessment of visual attention was completed prior to implementing the protocol with participants 2 to 5 years of age. This task analysis provided detailed steps of stimuli design and experimental session preparation. Six-minute experimental sessions examined visual attention for 28, 10-second robot (RDI) and human-delivered (HDI) instructional stimuli measured directly through eye-tracking. Pilot participants included two male children diagnosed with ASD. Areas of interest (AOI) were defined a priori based on salient features of the instruction. Data collection involved multiple gaze metrics, including gaze fixation and duration.
Results: Pilot data focused on gaze fixation and visualization of fixation points within AOI. Gaze fixation data for motor actions revealed greater visual attention to salient instructional features when viewing RDI versus HDI (Figure 1). Participants showed a greater number of fixation points following the pattern of movement in the RDI condition, as compared to fixation that was more localized to the face in the HDI condition. Gaze fixation data for verbal fill-ins showed visual attention within the AOI (head/mouth) in both RDI and HDI conditions (Figure 2). Gaze duration data indicated that sustained visual attention was greater in the HDI conditions as compared to RDI conditions. Additional data for up to 20 participants will be analyzed and discussed..
Conclusions: Differential patterns of visual attention within pre-defined AOI were observed across RDI and HDI conditions. Participants showed increased gaze fixation when viewing RDI for motor actions, suggesting the robot stimuli promoted increased attention to multiple salient features of instruction as opposed to more selective attention to a specific feature. Conclusions regarding utility of this methodology for evaluating RAI and implications for intervention will be discussed.

19 **178.019** Developmental Trajectories of ADHD Symptoms in Infants at Risk for ASD

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Background: Comorbidity rates between ASD and attention-deficit/hyperactivity disorder (ADHD) are as high as 40-70% (Antshel et al., 2016), making it important to better understand the presentation of ADHD symptoms in ASD. This is especially critical since the presence of ADHD symptoms in young children can delay a diagnosis of ASD by several years (Miodovnik et al., 2015). Very little research has focused on the early development of ADHD symptoms in infants developing ASD, despite the fact that a better understanding of the onset and early course of ADHD symptoms among infants at risk for ASD could improve early diagnostic and classification efforts and have implications for early intervention.
Objectives: We examined when differences in ADHD-related behaviors emerged among participants with either ASD or typical development (TD) outcomes.
Methods: Participants were drawn from a larger longitudinal study of infants at high- and low-risk for ASD (infant siblings); a subset of those with 36-month outcomes of either ASD (n = 14) or TD (n = 36) was included in the present investigation. We conducted second-by-second behavioral coding of videos from the 12-, 18-, 24-, and 36-month visits, examining four coded behaviors (Table 1) related to ADHD symptomatology (inattention, hyperactivity, out-of-seat behavior, and grabbing). Behaviors were coded from 5-minute video segments of structured testing. Group differences in ADHD-related behaviors from 12 to 36 months were examined via a Generalized Estimating Equations approach, using a negative binomial distribution with log link for each coded behavior.
Results: Â Estimated marginal means of each coded behavior are displayed in Figure 1. The interaction between inattention, visit, and outcome was significant (Wald χ^2 = 13.71, df = 3, p = .003). The ASD group significantly increased in the frequency of inattentive behavior over time, and significantly differed from the TD group at 36 months of age; there was also a trend toward more frequent bouts of inattention in the ASD group at 24 months. The interaction between out-of-seat behavior, visit, and outcome was also significant (Wald χ^2 = 10.44, df = 3, p = .015). The ASD group decreased over time and engaged in significantly fewer bouts of out-of-seat behavior at 36 months of age compared to the TD group. The interaction between hyperactive behavior, visit, and outcome was not significant (Wald χ^2 = 4.28, df = 3, p = .233), nor was the 3-way interaction for grabbing behavior (Wald χ^2 = .95, df = 3, p = .813).
Conclusions: Â Infants developing ASD showed more frequent bouts of inattention than infants developing typically by 36 months of age, as well as less frequent bouts of out-of-seat behavior by 36 months. Our findings contribute to the growing literature implicating early attentional processes in ASD (reviewed in Johnson et al., 2014) and is consistent with prior research documenting elevated rates of ADHD-related inattention symptoms in older children with ASD (Leyfer et al., 2006). Coding of the full sample is ongoing and may help clarify the unexpected finding of minimal group differences in hyperactive-impulsive behaviors.

20 **178.020** Developmental Trajectories of Sex Differences in Negative Affect in Infants with FXS and at ASD Risk

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Background: Research in Autism Spectrum Disorder (ASD) and fragile x syndrome (FXS) has predominantly focused on males due to sex differences in prevalence rates and increased phenotypic variability in females. Because temperament is relatively stable and accurately measured in infancy, it is a useful approach to understanding early developmental trajectories. Temperament has been linked to psycholobiological processes and systems, and thus may help identify early phenotypic markers of ASD that are tied to neurological or biological underpinnings. For example, a temperamental profile including higher negative affect has been shown to predict ASD in infant siblings (Garon et al., 2009).
There are reported sex differences in temperament in typically developing (TD) infants with girls rated higher on effortful control and boys higher on surgency, but no sex differences are observed in negative affect (Else-Quest, Hyde, & Goldsmith, 2006). However, no studies have examined sex differences in negative affect in infants at risk for FXS, and few have explored these questions in ASD. Because FXS is an X-chromosome linked, single-gene disorder associated with autism, it offers unique insight into the neurobiological sex differences in both disorders.
Objectives: To assess the differences in initial level and change of negative affect from 12- to 18- and 24-months by sex and risk group.
Methods: Participants included 109 infants assessed at 12, 18, and 24 months-of-age: 30 TD males, 25 ASIB males, 25 males with FXS, 9 TD females, 9 ASIB females, and 11 females with FXS. Most infants (n=94) had at least two data points. Parents completed the Infant Behavior Questionnaire at 12 months (IBQ; Rothbart, 1978) and the Early Childhood Behavior Questionnaire at 18-24 months (ECBQ; Putnam, Gartstein, & Rothbart, 2006).
Results: A growth model using hierarchical linear modeling (HLM) centered at 12 months was performed. Results demonstrated a significant effect of age, with groups showing less parent-reported negative affect over time t(171) = -12.65, p <. 0001, d = 1.66. There was a marginal effect of risk group t(100) = -1.82, p = .07, suggesting that the FXS group had less negative affect than the ASIB and TD groups (ds > .3) who were not different from each other (d = .07). No sex differences were found.
Conclusions: This study was the first to examine sex differences in negative affect in infants with FXS and those with an older sibling with ASD. Consistent with earlier reports of these relationships TD infants, we found no sex differences in any risk group. This work suggests that existing conceptualizations about negative affect and its relation to ASD may be applicable to both males and females with these disorders. Further, the marginal effect risk group points to the possibility that profiles for predicting ASD may differ by etiological group, especially considering other work suggesting that negative affect is related to ASD symptoms in ASIB infants but anxiety in infants with FXS (Tonnsen, Malone, Hatton, & Roberts, 2013). Given the impact of early detection and intervention, it is important that early phenotypic characterizations of these disorders consider the impact of sex differences.

21 **178.021** Do Toddlers at Familial Risk for ASD Differ in Their Electrophysiological Responses to Known and Unknown Words?

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Background:
Language is often impaired in individuals with autism spectrum disorder (ASD). Additionally, subtle atypicalities in language processing have been found in unaffected individuals at familial risk for ASD. In typically developing toddlers, neural responses, measured by event-related potentials (ERPs), vary depending on word familiarity and language ability (Mills et al., 2005). Kuhl and colleagues (2013) found atypical ERPs to words in toddlers with ASD. However, they did not control for language, so it is difficult to interpret whether these ERP differences were driven by ASD or the children's language abilities.
Objectives:
Our study investigates electrophysiological responses to words in 24-month-old toddlers with and without ASD, including those at familial risk, while controlling for language abilities.
Methods:
Participants
59 monolingual, English-speaking 24-month-olds were divided into three groups: low-risk control (LRC; N=34), high-risk for ASD (HRA; older sibling with ASD) without ASD (HRA-, N=21), and HRA children with ASD (ASD; N=4).Â
Procedure
ERPs were recorded while children passively listened to a stream of words playing from bilateral loudspeakers. Forty nouns were presented up to three times across two categories: 'known' words, confirmed through parent report, and 'unknown' words.
Analysis
Analysis focused on the mean amplitude of the N200-500 (negative component from 200-500ms post-stimulus onset) as its distribution varies depending on word familiarity (Mills et al., 2005). To analyze group differences, we used a mixed-model ANOVA with two conditions (known, unknown), two regions (parietal, occipital), and two hemispheres (left, right) as repeated measures and group (LRC, HRA-, ASD) as a between-subjects factor. We controlled for language abilities in our analyses using the verbal developmental quotient (VDQ) from the Mullen Scales of Early Learning (Table 1). We also investigated relationships between the N200-500 and language abilities and ADOS severity scores.
Results:
The results of the ANOVA found that there was a main effect of condition ($F(1,55)=4.34$, $p=0.042$) with a more negative amplitude for known words than for unknown words. There was also a significant group by condition by hemisphere interaction ($F(2,55)=3.86$, $p=0.027$). This was driven by a significant difference between groups in the left hemisphere in response to the known words ($p=0.037$). However, follow up on this revealed LRC, HRA-, and ASD groups were not significantly different from each other (all $p>0.10$; Figure 1). There were no other significant effects.
There was a significant relationship between the N200-500 in the right hemisphere sites and VDQ ($r_S=0.328$, $p=0.011$), such that toddlers with a less negative response in the right hemisphere had better language abilities. There were no significant relationships with ADOS severity scores.
Conclusions:
When controlling for language abilities, toddlers with ASD and unaffected familial members of ASD showed similar lateralization patterns in response to known words as their typically developing peers. Moreover, there was a significant relationship between the lateralization pattern of the N200-500 and language abilities but not with ASD severity. Thus, any differences in ERPs in response to language within these groups may be a result of varying language abilities as opposed to an ASD diagnosis or familial risk of ASD.

22 **178.022** Does Dyadic Synchrony and Responsiveness in the First Year Inform Later Autism Diagnoses?

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Background: Within dyadic play interactions, infants and their partners create temporal responsiveness and synchrony (Feldman, 2007). In the first year of life, the ability to engage in sustained synchronous interactions develops as infants learn to match play partner behaviors and sequentially regulate their behaviors in response to others (Feldman, 2007; Fogel, 1993; Tronick, 1989). Difficulty developing competence in these early social building blocks can inform later difficulties with language, joint attention, and emotion regulation (e.g., Granat et al., 2016). For children at elevated risk for autism (i.e., infant siblings of children with autism), it is unclear if early synchrony could inform later autism diagnoses and/or developmental progress/concerns.
Objectives: The present study explored if dyadic synchrony and responsiveness observed within the first year could inform autism diagnoses and other developmental progress/concerns at 36 months of age.
Methods: As part of a prospective study, 151 infants and their mothers (high-risk group n = 105, low-risk group n = 46) completed a standardized mother-infant play task when infants were 6, 9, and 12 months of age. These interactions were recorded and micro-coded for infant and mother gaze, affect, and vocalizations. Using these micro-codes, we created theory-driven composites for dyadic synchrony, responsiveness, and responsiveness timing (Table 1). At 36 months, infants/toddlers completed an assessment that included developmental functioning (via the Mullen Scales of Early Learning; MSEL) and were assigned diagnostic outcome classifications (i.e., autism, other developmental concerns, or typical development).
Results: Using linear and multinomial regression models, we assessed each composite at 6, 9, and 12 months as predictors of 36-month diagnostic outcomes and MSEL scores (with terms for infant sex, maternal education, and family income). Overall, the tested synchrony and responsiveness composites did not predict which children received an autism diagnosis. However, these composites did inform 36-month language development for all assessed infants, particularly when considering synchrony and responsiveness at 12 months of age (Table 1). For children who received an autism diagnosis, dyads coded as more synchronous and responsive in the first year had higher language scores at 36 months (Table 2). However, this finding was not consistent across the 6-, 9-, and 12-month assessments.
Conclusions: Dyadic synchrony and responsiveness, within the first year of life, did not inform which children would receive an autism diagnosis at 36 months. However, consistent with previous research (Northrup & Iverson, 2015), dyadic behaviors during the first year informed language progress for children with and without autism. The findings of the present study highlight mother-infant synchrony and responsiveness as a mechanism through which interventions may promote optimal development in children at elevated risk for autism.

23 **178.023** Does Eye-Tracking during Dynamic Videos Relate to Social Interactions in High-Risk Infants?

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Background: Poorly modulated eye contact is an early behavioral risk marker for autism spectrum disorder (ASD), facial processing difficulties, and joint attention development (e.g., Dawson et al., 2004). Quantifying eye contact within on-going social interactions can be difficult, and many researchers often use eye-tracking technology to assess where and for how long individuals look to the eyes (or mouth) of a speaker or perceived social partner (e.g., Chevallier, et al., 2015; Chawarska & Shic, 2009). However, we know relatively little about how these behaviors with 2D faces/partners relate to on-going live social interactions.
Objectives: We aim to replicate previous studies (e.g., Jones et al., 2008) by assessing the prospective associations between eye-tracking indexed look to eyes or mouth with elevated autism risk and later developmental concerns. Our novel contribution includes assessing how eye-tracking is associated with concurrent eye-contact modulation/competence within on-going social interactions.
Methods: Â As part of an ongoing prospective study, 21 infant siblings of children with autism (high-risk group; *n* = 12) or typical development (low-risk group; *n* = 9) completed an eye-tracking task and the Early Social Communication Skills (ESCS; Mundy et al., 2003) when siblings were 18 months of age. A dynamic video task was administered with *iMotions* software and a Tobii X2-60 eye-tracker. The coded video stimuli included three trials of a woman speaking to the observer with happy, neutral, and sad expressions and tones.Â Eye-tracking summary data included fixations and the amount of time infant spent attending to the speaker's eyes and mouth. For the ESCS, initiations of joint attention (IJA) were totaled for frequencies of lower-level, higher-level, and overall bids.Â By 36 months of age, infants/toddlers completed a developmental evaluation and the outcome groups of ASD, other, and typical development were assigned.Â Due to the limited sample size in the current study, outcome group was dichotomized into typical (TYP; *n* = 11) and non-typical (Non-TYP; *n* = 10).
Results: Â Risk and outcome group differences across the dynamic video task were assessed using general linear models with gender as a covariate.Â The high-risk group spent significantly less time looking to speaker's eyes during the happy trials (Table 1).Â When assessing by outcome, the Non-TYP group spent less time attending to speaker's eyes during the neutral trials, and Non-TYP group IJA scores were positively correlated with time spent looking to speaker's eyes during happy and sad trials and looking to the speaker's mouth during neutral trials (Table 2).Â These associations were not present in the TYP group.
Conclusions: Â These findings partially replicate previous research (e.g., Dawson et al., 2005) and demonstrate that (even in small samples) time spent looking to a 2D speaker's eyes can serve as a risk marker of later developmental concerns in children at elevated risk for autism. Additionally, time spent assessing eyes in emotionally salient videos (happy or sad) may serve as a proxy for eye contact modulation/competence within on-going social interactions. With replication, this quantification could serve as an intervention metric and/or research tool.

24 **178.024** Early Adaptive Functioning Trajectories in Preschoolers with Autism Spectrum Disorders

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Background: In preschoolers with Autism Spectrum Disorders (ASD), symptom severity has a negative impact on the development of adaptive functioning (Szatmari et al., 2015). Adaptive functioning impairments (e.g. dependency in activity as personal hygiene) critically impact the quality of life of those children and their family. Developmental features such as reduced social interest or the presence of behavioral problems can further impede daily life learning experiences (e.g. Chevallier et al., 2012, Fulton et al., 2014). However, so far, the development of adaptive functioning in young children with ASD remains speculative and has to be tested in a longitudinal multiple visits design.
Objectives: The first aim of the current study is to confirm the impact of high symptom severity on adaptive functioning trajectories in a sample of preschoolers with autism spectrum disorder. The second objective intends to explore whether reduced social interest and severe behavioral problems negatively affect developmental trajectories of adaptive functioning in young children with ASD.
Methods: Fifty-eight children with ASD (141 visits in total) and 29 age and gender matched typical developing (TD) children (64 visits in total) were longitudinally followed between 1.8 and 5.0 years old. At the baseline, diagnosis of ASD was confirmed with the Autism Diagnostic Observation Schedule (ADOS, Lord et al., 2000), which also allows defining symptom severity. Behavioral problems and social interest were also measured, using respectively, the Child Behavior Checklist for Ages 1.5-5 (CBCL/1.5-5, Achenbach & Rescorla, 2001) and a validated eye-tracking paradigm of visual preference for biological and non-biological motion (Pierce et al., 2012; Franchini et al., 2016). Besides baseline assessment, data on adaptive functioning were collected with the Vineland Adaptive Behavior Scales, 2nd edition (standard scores; Sparrow et al., 2005) every 6 months (for a maximum of two years).
Results: Using mixed models regression analyses we first demonstrated that children with ASD showed parallel developmental trajectories but significantly lower performance of adaptive functioning as compared to TD children ($p<0.0001$). Second, within ASD children, our results demonstrated that those with: 1) higher symptom severity ($p<0.0001$); 2) reduced social interest ($p=0.03$) and; 3) higher scores of behavioral problems ($p=0.01$) exhibited especially lower trajectories of adaptive functioning. However, the group by diagnosis interaction (i.e. slope of the trajectories) did not differ between these groups.
Conclusions: Our results support that, beyond high symptom severity, both reduced social interest and higher behavioral problems are also associated with lower adaptive functioning in young children with ASD. These findings further bolster the idea that social interest and behavioral problems are crucial for the early adaptive functioning development of children with autism. The current study has clinical implication in pointing out relevant targets for early intervention in ASD children.

25 **178.025** Early Detection for Risk of Autism Spectrum Disorder Using the Infant-Toddler Social and Emotional Assessment (ITSEA): A Prospective High-Risk Cohort Study

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Background: Characterizing the early development of children later diagnosed with Autism Spectrum Disorder (ASD) is crucial in order to identify early risk markers and potential targets for early intervention to improve functional outcomes. Recent evidence suggests that early social-emotional difficulties may predict later ASD symptomatology and developmental problems. This study examines whether scores on a parent-reported questionnaire, the Infant-Toddler Social Emotional Assessment (ITSEA), may be informative for early risk detection of ASD in a high-risk sibling population.
Objectives: The objective of the present study was to examine the relationship between parent-reported ITSEA scores at 18 months, and ASD symptomatology and diagnostic outcomes at 36 months in a cohort of toddlers at high-risk of developing ASD (HR; have older sibling diagnosed with ASD).
Methods: Three groups of toddlers participated: (1) HR siblings who did not receive an ASD diagnosis at 36 months (HR-N; n=238), (2) HR siblings who did receive an ASD diagnosis at 36 months (HR-ASD; n=93), and (3) low-risk toddlers with no family history of ASD (LR; n=133). Parents completed the ITSEA at 18 months. ITSEA domain scores (Externalizing, Internalizing, Dysregulation, and Competence domains), subdomain scores, and indices (Maladaptive, Social Relatedness, and Atypical indices) were calculated. At 36 months, an independent blinded diagnostic ASD assessment was conducted for all toddlers using the ADI-R and the ADOS. ITSEA scores were compared using a series of one-way ANOVAs with Group (HR-ASD, HR-N, LR) as the independent measure and Domain scores and Indices as the dependent measures. Group effects were explored using Benjamini & Hochberg (1995) corrections for multiple comparisons. Predictive contributions of the ITSEA were assessed using correlations between domain scores and indices at 18 months, and ADI-R and ADOS scores at 36 months.
Results: Parents of HR-ASD toddlers reported higher ITSEA scores on the Internalizing ($q \leq 0.001$) and Dysregulation ($q \leq 0.025$) domains, and Maladaptive ($q \leq 0.024$) and Atypical ($q \leq 0.001$) indices, as well as lower scores on the Competency ($q \leq 0.001$) domain and Social Relatedness ($q \leq 0.001$) index compared to parents of HR-N and LR groups. These results indicate greater impairment in social-emotional functioning at 18 months among HR toddlers later diagnosed with ASD. With respect to prediction, all ITSEA domain scores (with the exception of Externalizing in the HR-ASD group) and indices were significantly correlated with ASD symptomatology in both HR groups on the ADI-R (p's < 0.05). The Externalizing, Internalizing, and Dysregulation domains were correlated with the ADOS in the HR-ASD group (p's < 0.01), but not in the HR-N group.
Conclusions: Parental ratings on the ITSEA provide valuable information about the relation between early social-emotional functioning and later developmental outcomes in children who will and will not receive an ASD diagnosis. Specifically, HR siblings with ASD displayed marked social-emotional difficulties at 18 months, which predicted later ASD symptomatology and diagnostic outcomes at 36 months. These findings highlight the importance of considering social-emotional regulation when assessing the risk for ASD.

26 **178.026** Early Gesturing As a Screener of Subsequent Language Ability in Infants at Risk for Autism Spectrum Disorder

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Background: Siblings of children with autism spectrum disorder (ASD) are at a heightened risk for displaying ASD-like traits in early childhood and have an increased likelihood of developing this disorder (Constantino, Zhang, Frazier, Abbacchi, & Law, 2010; Ozonoff et al., 2010). Research on high-risk infants has found delays in understanding speech, producing vocalizations, or communicating through gestures at as early as 12 months (Mitchell, et al., 2006; Ozonoff, et al., 2010; Paul, Fuerst, Ramsay, Chawarska, & Klin, 2011).
Objectives: We examined parent report of infant gesturing at 12 months and its ability to predict language ability at 36 months for at-risk and typically developing (TD) siblings. We aim to determine if an easily accessible, cost-effective parent measure of gesturing is significantly associated with later language ability in at-risk infants.
Methods: The 126 participants included in this analysis were part of a longitudinal study of infants with an older sibling either with ASD (HRA; n=68) or without (LRC; n=58). Twelve siblings were diagnosed with ASD at 36 months based on the Autism Diagnostic Observation Schedule (ADOS) and clinical confirmation and were excluded from group difference analyses. We conducted an independent samples t-test to examine the differences between HRA and LRC on scores of gesture usage at 12 months using parent report scores from the MacArthur-Bates Communicative Development Inventories (MB-CDI), and receptive and expressive language at 18, 24, and 36 months using the Mullen Scales of Early Learning (MSEL). A partial correlational analysis was conducted to examine the association between parent-reported 12-month infant gesture, and 36-month language ability, controlling for 36-month nonverbal intelligence.
Results: Results were significant for early, late, and total gestures at 12 months (Early: $t(112)=3.82$, $p<.001$; Late: $t(112)=2.55$, $p=.01$; Total $t(112)=3.29$, $p=.001$). Results were also significant for expressive language at 24 and 36 months (24 months: $t(88)=3.32$, $p=.001$; 36 months: $t(60)=2.20$, $p<.05$), and receptive language at 18 and 24 months (18 months: $t(106)=4.10$, $p<.001$; 24 months: $t(88)=3.64$, $p<.001$). This indicates that HRA produced fewer gestures than LRC at 12 months, produced fewer sounds, words, and phrases at 24 and 36 months, and understood fewer words throughout the first two years of life. Additionally, we found that 12-month gesturing ability was associated with subsequent language ability at 36 months ($r=.40$, $p=.02$) in HRA infants, but not LRC ($r=.10$, $p=.53$).
Conclusions: We concluded that in at-risk infants, 12-month gesturing ability is associated with 36-month language ability, even when controlling for nonverbal intelligence. When examining TD infants, gesturing was not significantly associated with later language. This finding is inconsistent with previous research on TD siblings and could be due to LRC parents not being as cognizant of their child's gesturing ability. It is now clear that parent report measures of infant gesturing are associated with language ability at up to three years in high-risk populations. These results indicate that delayed gesturing may be easily identified through parent report measures. Clinicians should screen parents for these delays within the first year of life so that interventions can be implemented before symptoms manifest fully.

27 **178.027** Early Predictors of Social Anxiety in 12-Month-Old Infant Siblings of Children with Autism Spectrum Disorder

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Background: Siblings of children with autism spectrum disorder (ASIBs) are at elevated risk for anxiety later in life. In typically-developing infants, heightened social fear and atypical heart activity (e.g., respiratory sinus arrhythmia, RSA) have been shown to predict later social anxiety. However, very few studies have focused on the early risk markers of anxiety in ASIBs.
Objectives: Investigate fear and RSA in 12-month-old ASIBs and low-risk controls (LRCs) to determine if early risk markers of anxiety are present.
Methods:
Participants included 28 ASIBs (*M* = 12.94 months, *SD* = 1.33 months, 75% male) and 19 LRCs (*M* = 12.34 months, *SD* = 0.72 months, 74% male). Parent-reported fear was measured via the Fear Subscale from the Infant Behavior Questionnaire-Revised (IBQ-R; Gartstein & Rothbart, 2003). Observed social fear was measured by gaze behavior during a Stranger Approach paradigm. The proportion of time spent directing gaze toward the stranger served as an index of attention to threat. The proportions of time directing gaze to the parent and time averting gaze (i.e., looking away from the stranger and the parent) were also computed. Heart activity was recorded during a baseline period and during Stranger Approach. RSA was derived for both periods and RSA Change was calculated as Baseline RSA minus Stranger Approach RSA.
Results:
Independent samples *t*-tests were used to examine differences in parent-reported fear, observed social fear, and RSA. The ASIBs had higher parent-reported fear, $t(45) = -1.71$, $p = .09$, with Cohen's $d = .52$, indicating a medium effect size. During Stranger Approach, ASIBs and LRCs demonstrated similar gaze behavior, ts < ± 1.32, ps > .20. Groups did not differ on baseline RSA or Stranger Approach RSA, ts < ± .85, ps > .40. However, the LRCs demonstrated a greater RSA Change, $t(25) = 2.58$, $p = .02$. In ASIBs, baseline RSA was correlated with time averting gaze, $r = -.51$, $p = .04$, and RSA Change was correlated with time averting gaze, $r = -.69$, $p = .001$, and time gazing at the stranger, $r = -.50$, $p = .08$. No significant correlations between fear and RSA were observed in LRCs.
Conclusions:
Results suggest that behavioral markers observed in an experimental paradigm (i.e., behavioral fear) may not distinguish ASIBs at 12 months of age. However, parents of ASIBs did rate their children marginally more fearful than did parents of LRCs. Furthermore, ASIBs demonstrated suboptimal RSA Change in response to a stranger approach, a physiological profile associated with later social anxiety in community samples. Interesting correlations between heart activity and behavioral fear were observed in the ASIBs, but not the LRCs, supporting theories that poor physiological regulation contributes to disrupted modulation of attention and may be linked to anxiety later in development. In all, these findings suggest that individual differences in physiology and fear may be interacting in ASIBs to confer later risk for anxiety. Future studies should examine the longitudinal effects of such factors as they relate to anxiety outcomes in ASIBs.

28 **178.028** Elevated Levels of Glutamate in 4-6-Month-Old Infants at High Familial Risk of Autism Spectrum Disorders

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Background: There is now compelling evidence to suggest that abnormalities in excitatory and inhibitory neurotransmission may underpin 'atypical' development, including neurodevelopmental disorders such as autism spectrum disorder (ASD). Proton magnetic resonance spectroscopy (^{1}HMRS) provides an invaluable tool for studying brain metabolites *in vivo*. However, there have been no studies thus far examining the neurochemistry of ASD in early infancy; and so, we do not know if there are any neurochemical differences in infants-at-risk of developing the condition. This is an important omission, especially when considering that brain metabolite changes often precede structural abnormalities.
Objectives: In this study, ^{1}HMRS was used to investigate whether 4-6-month-old infants at high familial risk of ASD showed differences in brain metabolite ratios, when compared to low-risk controls. Infants were considered to be at 'high-risk' if they had at least one sibling with a diagnosis of ASD, and at 'low-risk' if they had no family (first-degree relative) history of ASD.
Methods: We acquired ^{1}HMRS at 3T from the basal ganglia of 33 infants (n=14 'high-risk' and n=19 'low-risk'), scanned between 4-6 months of age. Using a single voxel point resolved spectroscopy sequence (PRESS), set at an echo time of 55ms, glutamate measures comprised of glutamate plus glutamine (Glx) were obtained, and expressed relative to Choline (Cho) and Creatine (Cr) - i.e. Glx/Cho and Glx/Cr, respectively. Then, an analysis of covariance was used to test for group differences in these brain metabolite ratios. Infant risk group (low-risk versus high-risk) was input as a fixed factor, and the dependent variables of interest included: Glx/Cho and Glx/TCr. Infant age and sex were controlled for.
Results: Infants in the high-risk group had significantly higher levels of Glx/TCho [$F(1,21)=6.04$, $p=0.023$] and Glx/TCr [$F(1,21)=4.86$, $p=0.039$], when compared to those in the low-risk group, suggesting that absolute levels of Glx are elevated in 4-6-month-old infants at high-risk of ASD.
Conclusions: We emphasize that these results are preliminary and that data acquisition is still ongoing. Nevertheless, the findings presented in this study suggest that an imbalance in excitatory/inhibitory neurotransmission may be present in young infants genetically predisposed to developing ASD, and supports the notion that such an imbalance may partially underpin the pathophysiology of the disorder. Further proof that the glutamatergic pathway may be altered in infants-at-risk of ASD is required. However, the current findings should incentivize the ongoing search for pharmacological interventions targeting both glutamatergic and GABAergic systems.

29 **178.029** Examination of Developmental Sensitivity of Items on the Revised First Years Inventory Screener for Infants at Risk for a Later Diagnosis of ASD

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Background: Â The First Years Inventory (FYI) v3.1 is a newly revised parent-report questionnaire designed to identify infants at risk for a later diagnosis of ASD, expanding the target age from 12 months to 8-16 months. Each item on the FYI uses 5-point Likert scales (never to always) on items across two original domains (i.e., social communication; sensory-regulatory functions) and typical milestones. Due to potential maturational changes across this age range, the FYI items need to be assessed with respect to age norms and developmental sensitivity in order to develop a clinically useful scoring algorithm in the future. That is, a given screening item may be highly sensitive to ASD risk in a 15-month-old, but relatively insensitive to ASD risk in a 9-month-old. There is currently no "ASD-specific" parent-report screening tool for early risk markers in this age range that considers the effects of developmental sensitivity of individual items, which is a critical issue to address.
Objectives: The current study aimed to analyze a community sample of 5,960 infants aged 8-16 months to consider norms and developmental sensitivity of each FYI item across the domains of interest as a first step in creating a clinically more useful tool.
Methods: The FYI 3.1 was sent to ~40,000 families across North Carolina through the state birth registry. Each family received either an A or B version of the questionnaire to reduce time burden. There were 48 questions in each version with 27 core questions across the two versions, and thus 69 different items in total. We received 6,657 valid FYIs (response rate: 17%) and 5,960 were analyzed after excluding pre-term infants. Ordinal logistic regression analyses were conducted by item to examine the association between age and the 5-level ordinal response categories.
Results: Â There were 10 items showing statistically significant associations with age and Cox & Snell's pseudo R-square values ranging from 0.15-0.35, and all these items were in the domain of "social communication". Among them, two core items within the construct of "social initiation" had the largest R-square values (above 0.30).
Conclusions: The results showed that the developmental factor should be taken into consideration for ASD screening items related to social communication, but less so for sensory-regulatory functions. The statistically significant associations between age and item responses indicated that age explained a relatively large proportion of the variability in these item responses. The current results are supported by a longitudinal research indicating that social engagement increases linearly within the first 5 years of life, with major strides during the first year (Feldman & Eidelman, 2009). Accounting for developmental sensitivity when scoring specific items on ASD screening tools may help decrease false-positive screens for those of younger age within a wider age window. Follow-up studies are being conducted to optimize risk scoring algorithms and maximize prediction to ASD outcomes at age 3.

30 **178.030** Examining Sex Differences in Adaptive Behavioral Development in High Risk Infants with ASD, Social Communicative Delay, and Typical Development

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Background: There is notable phenotypic heterogeneity among high-risk (HR) siblings of children with autism who do not meet ASD diagnostic criteria. A substantial proportion of non-ASD HR siblings manifest a profile of subthreshold ASD symptoms and/or low developmental level compared to low-risk (LR) children (Messinger et al., 2013). More work is needed to understand heterogeneity in HR siblings and to potentially elucidate sex-specific differences, if present. Under-representation of females in research may obfuscate female protective effects or sex-specific ASD and subclinical social-communicative development.
Objectives: To determine whether sex differentially influences behavioral trajectories in ASD, social-communicative concern, and typical outcomes in a sample of HR infant siblings while controlling for genetic loading in families.
Methods: We examined 334(137F) HR and 123(55F) LR infant siblings, assessed at 6, 12, and 24-months. ASD classification at 24 months was based on CBE using DSM-IV criteria and by meeting ADOS criteria (HR-ASD, N=72(15F)). HR siblings with 24-month receptive or expressive language Mullen Scales of Early Learning scores one SD below the mean and/or ADOS social affect subscale score >5 were classified as HR-SocCom (N=87(36F)) to capture subthreshold, yet concerning social-communicative development. The remaining HR infants (N=175(86F)) are referenced as HR-TD. No LR infants had an ASD diagnosis. Experimentally controlling for genetic loading, the HR sample was restricted to participants with male probands, except HR-ASD females (as a female containing family may reflect different inheritance pattern). Five LME models were fit to each Vineland Adaptive Behavioral Scale (VABS) subscale and summary score. Predictors of interest include age, group, sex, and interactions. Benjamini-Hochberg correction was applied to pairwise group comparisons.
Results: Infants are more likely to be male in the HR-ASD group as compared to the HR-TD (RR=1.56, p=.00005) and the HR-SocCom (RR=1.35, p=.006). We observe equal sex proportion in the HR-SocCom and HR-TD groups (RR=1.15, p=0.241). All best-fit LME models of VABS subscales and composite score, except motor skills, include age, group, sex, and group-by-age effects. The motor skills best-fit LME model included age and group. Group-by-sex interactions did not improve fit in any model. 6-month ABC scores revealed the following pattern of group differences (LR-TD>HR-TD>HR-ASD, whereas the HR-SocCom group did not differ from the HR-TD or the HR-ASD group). 6-month motor scores revealed the following pattern of group differences (LR-TD>HR-TD=HR-SocCom>HR-ASD). Trajectories across the interval differentiated the groups in a consistent manner in the ABC, communication, and socialization domain, such that LR-TD=HR-TD>HR-SocCom>HR-ASD.
Conclusions: Experimentally controlling for proband sex, we did not observe specific sex effects on group trajectories of adaptive behavior from 6-24 months of age. Pairwise group differences revealed a gradient of attenuated adaptive behavioral development across groups. Relative risk discrepancy between HR males and females is maintained in ASD but not social-communicative concern, indicating sex may protect from diagnostic, but not subthreshold levels of concern. These data are consistent with previous reports (Constantino & Todd, 2003; 2005) suggesting that the M:F sex ratio differs by degree of affectation.

31 **178.031** Exploring Positive Affect in a Randomized Control Trial of the Social ABCs Parent-Mediated Intervention for Toddlers with Confirmed or Suspected ASD

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Keywords: ASD, early intervention, toddlers, parent-mediated intervention, communication, positive affect, smiling, social orienting
Background : The *Social ABCs* is a parent-mediated intervention (Brian et al., 2016) based on empirically supported Pivotal Response Treatment (PRT; Koegel & Koegel, 2006). The main targets of the *Social ABCs* are functional early (vocal/verbal) communication and positive affect sharing between child and caregiver among infants/toddlers who have suspected or diagnosed Autism Spectrum Disorder (ASD). Our positive affect target is motivated by evidence of reduced or declining positive affect, in high-risk infants, predictive of ASD outcomes (e.g., Bryson et al., 2007; Filliter et al., 2015; Landa et al., 2013; Ozonoff et al., 2010); this highlights the importance of positive affect as an early intervention target for toddlers with ASD, particularly given its importance in developing social relationships and learning generally.
Objectives : Bolstered by evidence of increased shared smiling between child and caregiver following participation in the*Social ABCs* intervention (p =.017; Brian et al., under revision; Bryson et al., IMFAR, 2015), we sought to further explore the impact of our intervention on person- vs. object-oriented smiling.
Methods : 62 parent-toddler dyads were randomized into the *Social ABCs* (treatment) group or received treatment as usual (control) across 2 Canadian research sites (Toronto and Halifax). Parents of toddlers aged 16 to 30 months received 12weeks of in-home, live coaching, followed by 12-week parent implementation. Here, we compare groups (treatment vs. control) on changes from baseline to post-training (week 12) in three key video-coded behaviours: (1) child smiling to caregiver, (2) parent smiling to child, and (3) child smiling at objects/activities.

Results : Paired samples t-tests (with Bonferroni correction) revealed: (1) parents in the *Social ABCs* group (but not controls) smiled significantly more to their children post-training relative to baseline (p=.002); (2) children in the *Social ABCs* group (but not controls) smiled significantly more to their caregivers following intervention (p=.02); and (3) children in the control (but not treatment) condition smiled significantly more to objects at the end of the 12-week period (p=.007) compared to baseline.

Conclusions: Significant gains were observed, only for the treatment group, in person-oriented smiling. Conversely, controls spent increasingly more time smiling at objects/activities, with no change in person-oriented smiling, over the same time period. In order to further investigate the role of positive affect, we will explore relationships between smiling and child communication, parent self-efficacy, fidelity, and stress. Next steps involve further elucidating the relevance of smiling as a treatment target in ASD, with discussion about the importance of positive affect in the development of social relationships and in learning more generally. Finally, we consider whether child smiling increased because the behaviour (smiling) itself was reinforced by caregivers, or whether it is better understood as an index of 'feeling good' in the context of the intervention.

32 **178.032** Exploring Sex Differences in Autism Spectrum Disorder in the Charge Study

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Background: Â Autism spectrum disorder (ASD) is more prevalent in males than females.Â Understanding the phenotypic differences between males and females may allow for insight into the etiology of ASD, which could guide sex specific screening, diagnostic and treatment pathways.
Objectives: Â To evaluate sex differences in developmental and adaptive function of young children with autism spectrum disorder (ASD)
Methods: The Childhood Autism Risk from Genetics and the Environment (CHARGE) study is an ongoing, population-based case-control study.Â Participants include children ages 2-5 years old with ASD and typically developing (TD) controls.Â TD children were age and location matched using birth certificate data.
For this analysis, all children who met criteria for ASD based on the Autism Diagnostic Observation Schedule, 2nd Edition (ADOS-2) and Autism Diagnostic Interview – Revised (ADI-R) were included. Any child with a known genetic syndrome was excluded.
We evaluated developmental and adaptive function in 724 children with ASD (612 M, 112 F) and 482 TD controls (397 M, 85 F) with a mean age of 44.1 months. Chi-square tests, ANOVA or logistic regression were used to evaluate differences in baseline demographics. T-tests, ANOVA, or Chi-square tests were used to assess differences in autism characteristics, including age at diagnosis, ADOS-2 comparison score, ADI-R scores and percentage of children enrolled in services. A 2X2 factorial ANOVA was used to estimate the interaction between diagnosis and sex for developmental and adaptive measures.
Results: There were no significant sex by diagnosis interactions in demographics. However, age at clinic visit and maternal education were both approaching significance. On further analysis, there was a main effect of diagnosis on both age (TDs younger, p=.005) and maternal education (TDs with more educated mothers, p=.01). Autism characteristics did not differ between males and females. As the outcome measures are standardized for age, only maternal education was used as a covariate in the following analyses. On the MSEL, there was a main effect of sex on visual reception (p=.01), receptive language (p=.02), expressive language (p=.02), fine motor (p=.003), and the early learning composite (p=.04) with females scoring higher than males in both ASD and TD groups. There were no significant sex by diagnosis interactions on the MSEL. On the VABS, there was a main effect of sex on communication (p=.02), daily living skills (p=.01), socialization (p=.03), and the composite (p=.02). There were also significant sex by diagnosis interactions in daily living skills (p=.001), socialization (p=.04), and the composite (p=.009). TD females tended to score higher than TD males, while males and females with ASD had similar adaptive skills.
Conclusions: Females scored higher than males in all aspects of developmental functioning in this sample, regardless of whether they were ASD or TD. However, only TD females outscored their male counterparts in adaptive skills. Therefore, a developmental advantage does not translate into superior adaptive functioning in females with ASD in this sample.

33 **178.033** Gender Differences in CSBS Scores

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Background: Â The prevalence of autism is reported to be higher among males than females, although the exact mechanism underlying this gender difference is unknown. Evidence suggests that phenotypic gender differences may account for some of this male bias in prevalence (Gould & Ashton-Smith, 2011). Specifically, differences in the manifestation of symptoms (e.g. females exhibiting fewer stereotypies) may result in females being underdiagnosed (Werling & Geschwind, 2013). The implications of gender differences in phenotypic presentation are diverse, starting with a need to re-examine, and potentially amend screening and diagnostic tools.
Objectives: Â This study's objective was to assess if gender differences exist in screening and diagnostic methods for autism.Â Specifically, we examined if Communication and Symbolic Behavior Scales Developmental Profile Infant-Toddler Checklist (CSBS) scores varied between male and female toddlers. The CSBS is a broadband screening tool used to detect various disorders, including autism (Wetherby et al., 2008). The CSBS comprises three composite scores (social, speech, and symbolic) and a total score.
Methods: Data were collected as part of a larger study, in collaboration with UCSD, that is testing a model called Get S.E.T. Early (S=Screen, E=Evaluate, T=Treat), designed to detect, evaluate, and treat autism within the first 2 years of life. Children from the general Phoenix and San Diego population are screened using the CSBS at 12-, 18-, and 24-month well-baby checkups. Children who fail the CSBS are referred for free developmental evaluations. Analyses for this study focused on two groups of children from the Phoenix cohort: (1) 7504 toddlers (3874 females and 3630 males) who passed all sections of the CSBS, and (2) 324 toddlers (82 females and 242 males) who failed at least one section of the CSBS and who received a developmental evaluation. Mean scores for males and females were compared using Bonferroni-corrected Mann-Whitney U tests.
Results: For toddlers who passed the CSBS, females scored significantly higher than males for the social (*MD*=0.36, *r*=.07), speech (*MD*=0.41, *r*=.09), and symbolic (*MD*=0.40, *r*=.07) composites, and for the total score (*MD*=1.17, *r*=.08). For toddlers who failed the CSBS and who received a developmental evaluation, no significant differences between males and females emerged for any composite score or the total score. Approximately 56% of the 242 evaluated males were at-risk for ASD, while only 38% of the 82 evaluated females were at-risk for ASD.
Conclusions: Although females who passed the CSBS had significantly higher composite scores, and total scores, than males who passed the CSBS, mean differences were negligible with small effect sizes, and statistical significance was likely achieved as a result of the large sample size. No gender differences emerged for children who failed the CSBS and who received a developmental evaluation. Despite this, approximately 3 times as many males than females failed the CSBS and received a developmental evaluation, and among those who received the developmental evaluation the odds of being at-risk for ASD were 2 times higher for males than females. This suggests that increased sensitivity on screening and diagnostic assessments for ASD is needed to better reflect the autism phenotype expressed by females.

34 **178.034** How Frequent Is Loss of Skills in ASD Associated with Genetic Abnormalities?

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Background: Â The rate of identification of genetic abnormalities in individuals diagnosed with ASD is rising. Functions of the involved genes include brain development and metabolic processes (de la Torre-Ubieta, Won, Stein, & Geschwind, 2016). The majority of extant literature on regression, or loss of skills, in ASD included samples considered "idiopathic," and thus has not explored if and how genetic abnormality association relates to specific patterns of symptom onset or loss. While we do know that regression may be associated with specific genetic vulnerabilities related to ASD and/or intellectual disability (Molloy, Keddache, & Martin, 2005; Neul et al., 2014), full exploration requires both large data sets as well as data from cohorts of specific genetic disorders associated with ASD.
Objectives: Â The purpose of this study was to investigate milestone attainment and loss of skills in individuals with genetic findings known to be associated with ASD, and in other specific genetic conditions.
Methods: First, we explored findings from the Simons Simplex Collection (SSC), including 112 probands with at least one *de novo* loss of function mutation copy number variants in, or including, a high confidence (*HC*) ASD gene or locus (an age, IQ, and sex-matched control group was selected from the remaining non-HC [*None*] group). Second, we report data from several natural history studies of genetic disorders, including Phelan-McDermid Syndrome (22q13 deletion or mutation; N=39; mean age 7.5+4.5 years), 15q13.3 deletion/duplication syndromes (Ndel=18; mean age 14.5+1.7 years; Ndup=18; mean age 9.9+3.0 years respectively), 16p11.2 CNVs, and 1q21.1 CNVs. The ADI-R was used to determine rates and pattern of skill attainment and loss.
Results: In the SSC cohort, the HC group had a significantly later mean age of walking than the None group. Both language and other skill loss were more common in the None group than in the HC group. Table 1 shows loss of language and other skills from preliminary data in the SSC cohort, as well as other genetic conditions. A fuller description of onset patterns, areas of loss, and current functioning in these cohorts will be provided, including the 16p11.2 and 1q21.1 cases.
Conclusions: While skill loss was more common in the SSC cohort when no genetic abnormality was present, it was present, along with a significant attainment lag in motor skills, in the HC group as well. Skill loss was relatively common in several other genetic conditions associated with ASD. These findings challenge the notion that regression is specifically associated with idiopathic or specific genetic conditions associated with ASD.

35 **178.035** IQ-Based Developmental Phenotypes of ASD Between Ages 2 and 7 Years and Their Correlates

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Background: Longitudinal Investigation of the developmental phenotypes of ASD offers a promising strategy for of identifying homogeneous pathophysiology-based subgroups. Here, we investigate cognitive phenotypes defined by IQ trajectory change between ages 2 and 7 in the Autism Phenome Project (APP) longitudinal cohort.
Objectives: To: (1) examine cognitive development between ages 2 and 7; (2) define ASD phenotypes derived from IQ-based developmental trajectories during this period; and (3) investigate associations between trajectory membership, and adaptive functioning, problem behaviors, and autism severity.
Methods: Latent class modeling using adjusted DQ scores derived from the Mullen Scales of Early Learning and the Differential Abilities Scale-II at ages 2 and 7 was implemented in 97 individuals with ASD. After classifying the ASD participants into trajectory groups, we examined changes in IQ, adaptive functioning, problem behaviors, and autism severity using a repeated measures approach with multiple comparison correction. All models included fixed effects for time, trajectory group, and their interaction. Problem behaviors, autism severity, and adaptive functioning were assessed using the CBCL, ADOS-2, and VABS-2, respectively.
Results: Three distinct IQ trajectory groups were identified. The first had IQs ≤ 77 at both times (**Greater challenges**: n=36; 37%). The second had IQs ≥ 75 at both times (**Lesser challenges**: n=23; 24%). A third group exhibited IQs < 82 at age 2, and had scores of ≥ 70 at age 7 with increases of ≥ 1 standard deviation (**Changers**: n=38; 39%). Repeated measures analyses revealed that the **Lesser challenges** group had significantly higher IQ scores than the **Changers** (31 points) and the **Greater challenges** groups (39 points) at age 2 (both p < .001). The 60% of the sample that was in either the **Changers** or **Lesser challenge**s groups had significant improvements in IQ from age 2 to 7 (30 and 10 points, respectively, both p<.001). On the VABS-2, at age 2, there were significant differences across trajectory groups, driven mainly by differences between the **Greater challenges** and the **Lesser challenges** groups (t=4.23, p<.001). On the VABS-2, between ages 2 and 7, the **Lesser challenges** group showed no change, while the **Changers** improved by 6 points (t=2.43, p=.02), and the **Greater challenges** group declined by 9.4 points (t=-4.5, p<.001). On the Externalizing scales of the CBCL, there was no group difference at age 2, however the **Changers** experienced a significant 8-point decline in Externalizing (t=4.32, p <.001), while the other groups did not. Autism severity changed significantly only in the **Lesser Challenges** group (t=4.88, p<.001).
Conclusions: A significant proportion of children with low early cognitive abilities will undergo significant intellectual development by age 7. This **Changers group** also exhibited significant reductions in externalizing symptoms by age 7, suggesting that reducing these symptoms by middle childhood is related to positive changes in cognitive development and adaptive functioning. Only the **Lesser Challenges** group showed a significant reduction in autism symptom severity during this period. A follow-up study of the APP at ages 8-12 is ongoing.

36 **178.036** Infant Gaze to Faces Across Interactive Contexts

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Background: Infant gaze is an important social-communicative behavior and is particularly relevant among infants at risk for autism spectrum disorder (ASD), who have been shown to exhibit atypicalities in gaze-related behavior in the first year of life. A common scenario in research settings, in which conditions need to be standardized across participants, is to measure infant social-communication behavior with an unfamiliar examiner, including during diagnostic assessments such as the Autism Diagnostic Observation Schedule. It is important to understand how infant behavior in structured contexts with novel social partners relates to behavior during interaction in a more familiar context (i.e., play) with a caregiver to assess whether skills in such structured settings generalize to other contexts.
Objectives: To investigate the relationship between gaze behavior during two different interactive contexts: structured testing with an unfamiliar examiner and unstructured play with a parent, in infants without and with a sibling with ASD.
Methods: Â Participants were classified into one of three groups based on diagnostic assessment at 36 months: low-risk non-ASD (*n*=53), high-risk non-ASD (*n*=66), or ASD group (*n*=17; 16 high-risk, 1 low-risk). At 6, 9, and 12 months, infants participated in two interactive contexts: 1) an unfamiliar examiner administered the Mullen Scales of Early Learning, a standardized developmental test, and 2) a play interaction with a parent, during which infants (in a high chair with a tray) and their parents (seated across from their infants) were provided a set of age-appropriate toys and instructed to play as they would at home. Infant social-communicative behavior was coded during the first 6 minutes of the examiner-administered Mullen Visual Reception subtest and during the 3-minute parent-child play interaction at each visit. The frequency of gaze to an adult's face was coded following procedures in Ozonoff et al. (2010). Frequency counts were then divided by the total duration coded to create rates of gaze per minute in each context.
Results: Â Regression analyses were conducted to examine the associations between infant gaze to face behavior in the two interactive contexts at each age, controlling for potential effects of familial risk or diagnostic classification. At 6 months, infant gaze to faces during Mullen testing approached significance in predicting infant gaze to face during parent-child play, β=0.25, standard error=0.14, p=.08. At 9 months, infant gaze to faces during Mullen testing significantly predicted infant gaze to face during parent-child play, β=0.34, standard error=0.10, p<.001. At 12 months, infant gaze to faces during Mullen testing significantly predicted infant gaze to face during parent-child play, β=0.46, standard error=0.14, p<.01.
Conclusions: Â Infant gaze behavior, a potential early marker of ASD, was significantly associated between two interactive contexts by 9 months of age, controlling for outcome group. Infants with higher levels of gaze to the face of an examiner during structured testing were likely to have higher levels of gaze to the face of a parent during unstructured play. This supports the validity of observing gaze behavior within laboratory settings, which appears to provide a representative measurement of an infant's skills in more naturalistic settings.

37 **178.037** Insecure-Resistant Attachment Classification (and behaviors) in Infants Later Diagnosed with Autism Spectrum Disorder

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Background:
Attachment security, assessed between 12-15 months using the gold-standard Strange Situation Procedure (SSP), is an index of early social-emotional functioning. Autism spectrum disorder (ASD) involves impairments in social-emotional functioning, including difficulties forming and maintaining relationships. Researchers have found that children with ASD are less likely to have secure attachments to their parent (Rutgers et al., 2004), largely using modified versions of the SSP at later ages and retrospectively after a child is diagnosed. Few studies have examined attachment security prospectively in infant siblings of children with ASD using the original SSP. In a previous study of infant siblings of children with ASD, we found that these high-risk infant siblings were not more likely to evince insecure attachment to their parent than infant siblings of typically-developing children (Haltigan et al., 2011).
Objectives:
To determine whether attachment security at 15 months differs by later diagnostic outcome at 36 months (ASD or no ASD diagnosis).
Methods:
Infant-parent dyads (*n*=95) completed the SSP at 15 months. Infants were reliably classified by expert raters as secure (*n*=72), avoidant (*n*=10), or resistant (*n*=13). Attachment was also examined as a continuous score along two dimensions: approach/avoidance behaviors and resistance/disorganization behaviors (Spieker & Fraley, 2003). The sample included infants without (low-risk) and with (high-risk) an older sibling with ASD. At 36 months, a diagnosis of ASD was determined for low- and high-risk children by an experienced clinician informed by the Autism Diagnostic Observation Schedule. We assessed differences in attachment security in low-risk children (Low-Risk/No-ASD, *n*=39), high-risk children with no ASD diagnosis (High-Risk/No-ASD, *n*=40) and high-risk children with an ASD diagnosis (High-Risk/ASD, *n*=16).
Results:
The frequencies of secure and insecure attachment classifications differed between the three outcome groups, $p<.005$, as children with ASD were disproportionately more likely to be classified as insecure than children without ASD (**Figure 1**). The frequencies of secure, resistant, and avoidant attachment differed between the three outcome groups, $p<.02$, as children with ASD were more likely to be classified as insecure-resistant than children without ASD (**Figure 2**). High-Risk/ASD infants had higher resistance/disorganization scores than both Low-Risk/No-ASD and High-Risk/No-ASD infants, $F(2, 92)=3.469$, $p=.035$, but did not differ along the approach/avoidance dimension, $F(2,92)=.786$, $p>.05$.
Conclusions:
Using a prospective design, we found that high-risk infant siblings *who are later diagnosed with ASD* are able to form attachment relationships with their caregivers, but are more likely to display insecure attachment patterns compared to children without ASD. High-Risk/ASD infants exhibited more resistant and disorganized strategies when interacting with their parents. These prospective findings suggest that half of infants who go on to develop ASD have early social difficulties that interfere with their ability to establish a secure attachment with their caregiver. Alternatively, the increased resistant/disorganized scores in the ASD group may be indicative of underlying neurological impairment rather than an indicator of a problematic attachment relationship (Pipp-Siegel et al., 1999). It is also possible that High-Risk/ASD infants, because of temperamental variables or the early emergence of ASD symptoms, may tax caregivers' ability to be sensitively responsive to their infants.

38 **178.038** Interactions Between Young Children with Autism Spectrum Disorder and Their Caregivers

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Background:
In research with young children with autism spectrum disorder (ASD), observing caregiver-child interactions provides an opportunity to assess children's social-communication behaviors and caregivers' parenting styles. One assessment used, the Indicator of Parent Child Interaction (IPCI), an Individual Growth and Development indicator (IGDI) has been used frequently in educational assessment with infants and toddlers, but less so in research with young children with ASD. The current study examined parent-child interactions with the IPCI with a group of toddlers with ASD.
Objectives:
Our specific aims include:

1. To examine caregiver interaction behaviors as measured by the IPCI.
2. To examine child interaction behaviors as measured by the IPCI.
3. To identify caregiver and child characteristics that may affect their interaction behaviors.

Methods:
Thirty-three young children with or at risk for ASD, as determined by the Modified Checklist for Autism in Toddlers (M-CHAT), participated in the IPCI with a primary caregiver as part of a larger intervention study. Children ranged in age from 17 to 42 months old, with a mean of 24 months. Primary caregivers were mostly female and ranged in age from 25 to 52 years, with a mean of 35 years old. The IPCI consists of four semi-structured parent-child activities (free play, looking at books, distraction task, and dressing), similar to those that might be observed in daily family routines. Episodes were videorecorded for a total of ten minutes and coded in 30-second intervals on 6 caregiver interaction behaviors (warmth and acceptance, descriptive language, follows lead, maintaining/extending, harsh/critical, and restrictions) and 6 child interaction behaviors (positive feedback, sustained engagement, follow through, irritable/fuss/cry, external distress, and frozen/watchful). Children were also assessed on the Mullen Scales of Early Learning from which a mental age score was calculated.
Results:
Caregivers engaged in descriptive language with their children in over half of the intervals (M=10.42, SD=5.20). In almost half of intervals, caregivers were observed following the child's lead (M=8.06, SD=4.39). No harsh or critical caregiving behaviors were observed. Children demonstrated sustained engagement in play with a toy for approximately half of the intervals (M=10.36, SD=3.87); however, children displayed positive affect such as smiling at their caregiver in only about 5% of the intervals (M=1.15, SD=2.25). No children demonstrated frozen/watchful behavior. Parents' use of descriptive language and children's engagement were positively correlated with children's mental age scores (r=.417, p<.05; r=.375, p<.05, respectively).
Conclusions:
Findings from this descriptive study provide valuable information about caregivers' and children's behaviors during interactions across several different activities. In particular, caregivers used descriptive language over half of the time with their toddlers, and more so when toddlers had higher cognitive skills. Furthermore, children with higher cognitive scores demonstrated more engagement in activities with caregivers than children with lower scores. Future research will examine how aspects of caregiver-child interactions may change over time as related to an intervention to enhance interaction quality.

39 **178.039** Investigating the Construct Validity of the Social Communication Schedule for Young Children with Severe Visual Impairment 'at Risk' of ASD: Relations with the Child Behaviour Checklist

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Background:
Children with congenital profound or severe visual impairment (VI) are at high risk of ASD and social communication difficulties. Studies report a much higher prevalence of ASD in children with VI (~30%) compared to rates in the sighted population (Jure et al., 2016). Socio-communicative difficulties in children with VI become evident from around 2 years of age (Dale & Sonksen, 2002). Existing tools used to measure early socio-communicative development are highly vision-dependent and not valid for children with VI. We developed the Social Communication Schedule (SCS) to examine social-communicative difficulties in 2-year-olds with VI. SCS is based on the Visual Impairment and Social Communication Schedule (VISS - Absoud et al., 2010), which had preliminary validation with children with VI and was highly reliable in predicting a later diagnosis of ASD. The SCS was developed further to include standard behavioural items and social 'presses' to elicit social and communicative behaviours that allow for reliable behavioural coding. We also developed the Negative Behavioural Screener (NBS) to examine ASD related difficulties including repetitive behaviours. To begin to establish construct validity parents completed the Children's Behavior Checklist (CBCL 1.5 – 5 years), a standardized parental questionnaire which measures behavioural difficulties and problems in preschool children. It includes the subscale PDP (Pervasive Developmental Problems) which has consistently provided predictive relations with existing ASD screening tools (Muratori et al., 2011; Sikora, et al, 2008).
Objectives:
To examine the construct validity of the SCS and NBS at 2 and 3 years of age by cross-sectional and longitudinal comparisons to the CBCL PDP subscale.
Methods:
Preliminary data from 50 children at 2 years (M=26.10, SD=2.30) and 39 at 3 years (M=38.28, SD=2.91), with 'simple' congenital disorders of the peripheral visual system from the longitudinal OPTIMUM project (Dale et al.) were rated using the SCS (high scores indicated better social communicative abilities) and a negative behaviour screener (NBS – higher scores indicated more negative behaviours), whilst engaging in social and independent play tasks. Parents rated the CBCL when children were 2 and 3 years of age and the PDP subscale was extracted for analyses.
Results:
Strong negative relations between SCS scores and NBS scores (**ρ** =-.73, p<.001), suggested that children who scored higher on socio-communicative abilities on SCS had lower negative behaviour scores on NBS. At 2 years of age, a negative correlation was found between PDP and SCS (**ρ** =-.45, p<.01) and a positive correlation between PDP and NBS (**ρ** =.37, p<.01). Similar patterns were found at 3 years on the same scales (**ρ** =-.41, p<.01, **ρ** =.48, p<.01). Children with lower SCS scores and higher NBS scores were rated higher on PDP by parents at both time points.
Conclusions:
The SCS, which is newly developed for young children with VI, and NBS showed moderate relations with the CBCL PDP subscale at 2 and 3 years. Findings suggest that this 'early stage' tool may provide a useful means of differentiating behaviours, which may be early signs of autism.
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40 **178.040** Preschool Peer Relationships in Younger Siblings of Children with ASD

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Background: Peer competence and friendships are major developmental achievements in middle-childhood and are related to emotional well-being and academic skills. Peer relationships in preschool provide opportunities to develop the skills required for these achievements. By school-age, children with ASD demonstrate fewer reciprocal friendships and poorer peer competence than same-age peers. However, little is known about peer relationships in preschool-age children with ASD. Younger siblings of children with ASD may be at risk for poor peer competence and friendships due to higher rates of ASD (~20%) and other developmental and psychiatric conditions (~25%), but no empiric studies have yet described peer relationships in this high-risk (HR) population. Caregivers play an important role in promoting peer competence during preschool, but it is not yet known to what extent having an older sibling with ASD may impact early peer relationship development in this high-risk group.
Objectives: We examined 1) peer relationships in preschool-aged HR vs low-risk (LR) younger siblings, 2) factors associated with poorer peer relationships, and 3) peer relationship support activities among caregivers with an older child with ASD (HR) vs typical development (LR).
Methods: Data include 70 HR (16 ASD-pos; 54 ASD-neg) and 36 LR participants enrolled in the Infant Brain Imaging Study at 6 or 12 months with peer relationships measured during preschool (age 3-5). Diagnosis (based on DSM-IV-TR) and language ability (Expressive and Receptive Language, Mullen Scales) were directly assessed by research reliable clinicians across 4 sites at age 3-5 or at 24 months for 20 HR-ASD-neg children assessed only by questionnaire at age 3-5. Peer relationships (Peer Social Contact Questionnaire; Guralnick, 1997), and problem behavior (Internalizing and Externalizing scales, CBCL) were assessed through parent-report at preschool age.
Results: The HR-ASD-pos group had significantly fewer peer playmates than the HR-ASD-neg and LR-neg groups (F(2,103)=7.80, p<.001) and lower quality peer interactions than HR-ASD-neg group (F(2,79)=4.66, p<.05). Half of ASD-pos preschoolers had no playmates vs 20% of HR-ASD-neg and 20% of LR. HR-ASD-pos children with no peers had higher internalizing and externalizing behavior than those with peers, and HR-ASD-neg and LR groups. Caregivers of HR-ASD-pos children reported significantly greater stress while monitoring play (F(2,77)=4.82, p<.05) and greater need to directly facilitate peer play interactions (F(2,76)=4.20, p<.05). HR-ASD-neg and LR caregivers did not differ regarding stress while monitoring or facilitating.
Conclusions: Children with ASD already demonstrate precursors to poor peer competence and friendship outcomes by preschool, with fewer playmates and lower quality peer relationships. Having an older sibling with ASD does not increase caregiver stress or monitoring demands during younger sibling playdates. Importantly, arranging playdates is no more difficult for caregivers of preschoolers with ASD, caregivers with an older sibling with ASD (HR-ASD-neg) or caregivers with only typically developing children (LR). However, caregivers of preschoolers with ASD report increased stress while monitoring playdates as compared with HR-neg and LR caregivers. The preschool years may be well-suited for implementing parent-delivered interventions to support the development of peer competence in younger siblings of children with ASD and to reduce caregiver stress while monitoring play.

41 **178.041** Motor Delays in Infants and Toddlers with ASD and Social Communication Delay

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Background: Infants having an older sibling with an autism spectrum disorder (ASD) are at heightened risk (HR sibs) for ASD and other delays. Differences in HR sibs' postural control, grasping, and anticipatory action responses have been reported but little is known about how these manifest in children later identified as exhibiting ASD, non-ASD social or communication delay, or no delays.
Objectives: Examine motor development between ages 6-24 months in children at heightened risk for ASD and other social communication delays, and the relation between these and developmental status between 24-36 months.
Methods: HR sibs (N=150, 95 males) and LR controls (N=60, 27 males) in this prospective, longitudinal study were assessed with the Peabody Developmental Motor Scales-2 (PDMS; Folio & Fewell, 2000) at ages 6, 10, 14, 18, and 24 months. Dependent variables were PDMS raw scores on the (1) Stationary, (2) Object Manipulation, (3) Grasping, and (4) Visual-Motor Integration subscales. Between ages 24-36 months, children were classified as No Delay (N= 134, 66 males, 79 HR, 55 LR), Social or Communication Delay (Other Delay, N= 45, 32 males, 39 HR) or ASD (N= 32, 24 males, 32 HR) using Mullen Scales of Early Learning (for No Delay and Other Delay groups), and ADOS scores and clinical judgment (for all three groups).
Results: LR and HR children in the No Delay and Other Delay groups performed similarly, so were combined for analyses to maximize sample size. Multiple one-way ANOVAs (with Bonferroni corrections) revealed significant group differences across the three groups defined by outcome classification (No Delay, Other Delay, and ASD) within each age (6, 10, 14, 18 and 24 months; e.g., Figures 1, 2). Children in the ASD group scored significantly lower on Stationary and Object Manipulation subscales than the No Delay group at 18 months and 24 months. On the Visual-Motor Integration subscale, the ASD group scored significantly lower than the No Delay group at an early age (6, 10, and 14 months). On the Grasping subscale, the ASD group scored lower than both No Delay and Other Delay groups only at age 24 months. Interestingly, the Other Delay group differed from the No Delay group on Stationary skills at 24 months and from the ASD group on Object Manipulation and Grasping subscales at 24 months.
Conclusions:
Children with ASD exhibited delay in motor development from mid-infancy into early toddlerhood. The earliest distinguishing delay was observed in visual-motor integration. This has implication for development of perception-action coupling, and could deter efficient and timely anticipatory responses and interpersonal synchrony in children with ASD. Later in the second year, toddlers with ASD exhibited slowing in fine motor development in areas integral to play development. Gross motor delays were identified in toddlers with social and communication delays at age 24 months, when more complex gross motor skills are expected to emerge. Research examining the association between these early delays and concurrent and later play and social communication in children with ASD and social communication disorders is needed.

42 **178.042** Mouse Model of Chd8 Haploinsufficiency Results in Altered Neuronal Proliferation and Megalencephaly

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Background: Efforts to uncover the genetic basic of Autism Spectrum Disorder (ASD) via exome sequencing of autism patients have identified the chromodomain helicase binding protein (*CHD8*) as a candidate gene. Patients with de novo mutations in *CHD8,* resulting in loss of function and haploinsufficiency, show a clinical presentation of autism comorbid with cognitive impairment, macrocephaly, craniofacial dysmorphology, and gastrointestinal issues.
Objectives: To uncover neurodevelopmental pathology associated with *CHD8* haploinsufficiency driving in autism, macrocephaly, and impaired cognition utilizing a mouse model
Methods: We generated a mouse model harboring a germline mutation in *Chd8* using the CRISPR/Cas9 system. We performed RNA-sequencing across development to analyze changes in gene expression in *Chd8* heterozygous (*Chd8*$^{+/-}$) forebrain. We used EdU labeling to measure neuronal proliferation at embryonic day 13.5. We utilized a battery of behavioral tests to assess social, repetitive and cognitive behaviors in adult *Chd8*$^{+/-}$ mice.
Results: Consistent with previous publications, homozygous deletion of *Chd8* in our mouse model is embryonic lethal. We found altered expression of early neurodevelopmental and differentiation genes in *Chd8*$^{+/-}$ forebrain, including sets of genes critical for RNA processing (including RNA splicing, mRNA stability, and transport) and chromatin structure and organization. *Chd8*$^{+/-}$ mice have increased neuronal proliferation in the ventricular zone at embryonic day 13.5, the peak of neurogenesis. We observed increased cortical length and cortical thickness at postnatal day 7. Cursory examination of cortical lamination revealed no obvious differences in layer specification in at postnatal day 1. Our behavioral assays did not reveal social or anxiety phenotypes in assays that have face value validity for autism. Preliminary analysis in a fear-based learning task suggested impaired cue and correlative learning in *Chd8*$^{+/-}$ mice.
Conclusions: Our mouse model recapitulates human macrocephaly phenotype, reveals elevated neuronal proliferation as a possible root for brain size increase, and provides insight into the gene expression networks altered by mutation of one copy of the *Chd8* gene.

43 **178.043** Neurodevelopmental Consequences of Fetal Androgen Exposure Depend on Sex

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Background: Autism spectrum disorder (ASD) displays a striking sex bias, which has fueled research around the hypothesis that aberrant sex hormone exposure may be a contributing factor to the condition. Previous studies utilized morphological features that are known to reflect androgen exposure – e.g. digit ratio or facial features – to explore the biological mechanisms behind ASD. However, few studies have compared these measures to the specific traits prevalent in the disorder. Even fewer have broadened their sample to include not only individuals with ASD, but also typically developing individuals and those with other neurodevelopmental conditions such as language impairment or intellectual disability. With a diagnostically diverse cohort, determining the influence of prenatal androgen exposure on clinically relevant traits will further our understanding of the role of sex in neurodevelopment.
Objectives: Â This study investigated the relationship between prenatal androgen exposure and behavioral traits that exist to varying degrees in the general population but are particularly pronounced in individuals diagnosed with ASD.
Methods: Â 642 individuals spanning a spectrum of social, behavioral, communication, and cognitive capabilities were recruited from hospitals and clinics across the state of Iowa. Two morphological features – digit ratio and facial masculinity – were used as proxy measures for prenatal androgen exposure. 2D:4D ratios were calculated from finger length measures obtained from subjects' hand scans; facial masculinity was determined through computational analyses of subjects' photographs. Self- and parent-reports were corroborated by examination of medical records to determine medical history and comorbidities. Scores for 'Social Deficit', 'Sensory Sensitivity', 'Restricted/Repetitive Behaviors', 'Anger/Aggression', and 'Cognitive Deficit' were calculated from these responses.
Results: The two morphological features used to reflect prenatal androgen exposure – 2D:4D ratio and facial masculinity – were significantly correlated. Both measures were associated with ASD-related characteristics, in a sex-dependent manner.Â In male subjects, greater prenatal androgen exposure correlated with fewer restricted/repetitive behaviors, lower aggression, fewer sensory sensitivities, and less severe cognitive deficits.Â In female subjects, greater prenatal androgen exposure resulted in more severe behaviors and deficits. Overall, neurodevelopmental symptomatology was more severe when prenatal androgen exposure was discordant with biological sex.
Conclusions: The influence of prenatal androgen exposure on ASD-related behaviors, social abilities, and cognitive deficits is mediated by sex. These effects are not limited to individuals with ASD or other neurodevelopmental conditions, as they were detectable in both clinical and subclinical populations.

44 **178.044** Parent-Child Co-Regulation in Toddlers with ASD

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Background:
Individuals with ASD have been known to exhibit deficits in emotion regulation (ER) capabilities (Konstantareas and Stewart, 2006). These deficits, in combination with impairments in social and emotional development that are characteristic of ASD, may compound negative outcomes and even moderate children's response to intervention and treatment (Jahromi et al, 2012). In addition, parents, more specifically mothers, of children with ASD may serve a crucial role in facilitating and fostering their children's ER development (Morris et al., 2011). In a sample of toddlers with ASD, mothers were found to use a range of strategies to co-regulate their child's negativity in a free play interaction (Gulsrud et al., 2012).
Objectives:
This study aims to identify potential ER and co-regulation strategies used by toddlers with ASD and their parents during a distress task.
Methods:
77 toddlers with ASD (24 – 36 months) completed a 3-minute distress task based upon the Lab-TAB distress task used with typically developing preschoolers (Goldsmith, Reilly, Lemery, Longley, & Prescott, 1999). Toddlers were given a locked toy box and a ring of keys and encouraged by parents to open the box. VideosÂ of the task were codedÂ for child negativity and then in 10-second intervals for presence of nine measures of child emotion regulation ER strategies and five parent co-regulation strategies. Descriptive statistics were collected on the types and frequencies of parent and child ER strategies, and the frequency of children's expressed negativity. Chi-squared tests of independence were conducted to determine whether a relationship existed between strategy use and children's expressed negativity. Finally, a bivariate correlation was conducted to discover whether a relationship exists between child's ER strategy use and ADOS (ADOS; Lord et al., 1989) severity score.
Results:
Findings showed that children most frequently used "distraction" as a strategy, appearing in 57.1% of sessions. The least used child strategy was "physical self-soothing", coded in 5.2% of sessions. Children used ER strategies on average 17.84 times (SD=8.80) per session. Parents were found to most frequently use "following" as a co-regulation strategy, utilized in 41.6% of the sessions. The least employed parental strategy was "active game-like engagement", appearing in 1.3% of sessions. Parents used co-regulation strategies on average 2.32 times (SD=2.80) per session. Findings revealed that children used significantly more "tension release" ($p=0.000$) and "other-directed assistance seeking" ($p=0.013$) during sessions with negativity, and significantly more "idiosyncratic behaviors" ($p=0.014$) during sessions with no negativity. One parent strategy, "physical comfort" approached significance, appearing more in the presence of no negativity ($p=0.054$). A bivariate correlation revealed a significant correlation between child's ADOS severity score and the frequency of their ER strategy use ($r = 0.491$, $p < 0.01$).
Conclusions:
Results revealed that parents rely on a variety of strategies when attempting to co-regulate their toddlers with ASD, especially during distressing tasks. Children with ASD also attempt to regulate their own negative emotions, relying most heavily upon "tension release" and "other-directed assistance seeking". Findings also suggest that ER strategy use increases in frequency in correlation with the severity of the child's ASD.

45 **178.045** Perceptions of the Parenting Experience Among Caregivers of Toddlers: Comparison of ASD Risk and Non-Risk Groups

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Background: Parenting a child with autism spectrum disorder (ASD) may be especially challenging due to symptoms of ASD and the associated problems (e.g., regulation during daily living tasks; externalizing behaviors; Davis & Carter, 2008; Ming et al., 2008). Whereas much research on children with ASD assesses deficits, relatively fewer studies have examined strengths. Nevertheless, including an assessment of strengths is important, as they may protect against parental stress (Carter et al., 2003) and can provide a broader picture for intervention planning (Oswald et al., 2001).
Objectives: The present study compares perceptions of parenting among caregivers of two groups of children—those above and those below the cut-score consistent with an ASD diagnosis on the Modified Checklist for Autism in Toddlers (M-CHAT). Understanding more about parents' perceptions of both difficulties and strengths can inform interventions to ameliorate difficulties and build upon strengths with a goal of reducing parenting stress.
Methods: Data were drawn from a national primary care sample who completed online questionnaires prior to children's health supervision visits. Caregivers of 5,690 children, aged 16-30 months (*M* = 1.30 years; *SD* = 1.85; 67.8% European-American, 30.2% African-American) completed the M-CHAT (Robins, Fein, Barton, Green, 2001), a validated parent-report for screening toddlersÂ for ASD. These caregivers were also asked to choose one or two items from 22 choices representing the best parts of parenting and one or two items from 23 choices representing the hardest parts of parenting. Best and hardest choices were theoretically and clinically derived.
Results: Consistent with the general population base rate (APA, 2013), 1.14% (*n* = 65) scored 7 or higher on the M-CHAT (indicating a possible diagnosis of ASD). Group comparisons (M-CHAT <7 and >7) for items most frequently endorsed as the best parts of parenting and the hardest parts of parenting are presented in Figures 1 and 2, respectively. Overall, caregivers most frequently endorsed playing with him/her, the way he/she smiles, and watching him/her with siblings among the best parts of parenting. Caregivers most frequently endorsed crying/fussing/tantrums and managing other stress among the hardest parts of parenting. Chi-square analyses indicated the same pattern regardless of M-CHAT scores for most choices. However, there were statistically significant differences for wondering if I am a good enough parent (*p* = .04; endorsed more in the M-CHAT <7 group) and too much/not enough help/advice (*p* = .03; endorsed more in the M-CHAT >7 group).
Conclusions: Even among caregivers of children with a significant M-CHAT score, the parts of parenting identified as best included social (i.e., interactions with family) and early communicative (i.e., smiling) behaviors. Likewise, these caregivers endorsed struggling with the same child behavior problems and other stress as other caregivers, with a few significant differences. These results underscore the commonalities in the experience of caregivers of toddlers, regardless of level of child ASD symptoms. These findings highlight the importance of targeting social skills and communication in early interventions with at-risk children as well as assisting caregivers to build skills to address behavior problems and reduce stress.

46 **178.046** Physiological Measurements of Voice Quality in Children with Autism Using Electroglottography in Relation to Clinical Assessment Outcome

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Background:
Atypical voice quality has been a characteristic trait in individuals with autism. Many standard clinical assessment tools include subjective evaluation of voice characteristics and social communication skills for clinical diagnosis of autism. However, a means of statistically quantifying atypicality in voice production in individuals with autism that can also contribute to reliable prediction of clinical diagnosis is still lacking. In previous research, we showed that longitudinal acoustic measures of infant vocal behavior including the fundamental frequency contour, duration and timing of dyadic interactions with caregivers within the first two years of life have potential as biomarkers for early detection of autism. However, acoustic measures of prosody do not directly quantify the actual mechanism of voice production. Electroglottography (EGG) provides non-invasive physiological measures of vocal fold function, and voice source parameters obtained through EGG signal processing may therefore provide us with better information about the origin of voice disorders in autism.
Objectives:
The goal of this study is to explore the potential of physiological measures of voice quality to capture information relevant to diagnostic characterization by correlating acoustic measures of voice quality obtained using EGG with standard measures used for clinical assessment of language and social communication in autism spectrum disorders (ASD). We test the hypothesis that objective measures of abnormal voice quality characteristics are predictive of clinical outcome.
Methods:
As part of our initial pilot study, we recruited in total 8 low-risk children with no history of autism and high-risk children with older siblings diagnosed with ASD. We collected high-quality EGG and microphone recordings of each child at 2-3 years of age. We also collected a battery of clinical assessment measures from each child at the same age. From the EGG recordings, we hand-labeled and extracted sequences of utterances containing clean child vocalizations and calculated the mean and standard deviations for four measures of voice quality across all speech frames for each child: the fundamental frequency (F0), the open quotient (OQ), the return quotient (RQ), and the speed quotient (SQ). We then compared the correlation between physiological measures of voice quality with clinical outcome measures corresponding to social communication and motor control.
Results:
Our final sample consisted of 4 TD children and 4 children diagnosed with ASD. Group differences in all of the four acoustic measures of voice quality showed significant correlation with each other and may have potential to aid prediction of diagnostic characterization. Group-level categorizations based on these physiological measurements of voice quality were consistent with categorizations based on the ADOS summary scores.
Conclusions:
Preliminary results suggest that typically developing children and children with ASD differ according to physiological measures of atypical voice quality which may be related to clinical outcome measures. However, these observations and results are currently being further verified on a larger cohort.

47 **178.047** Positive Affect in Infants at High Risk for ASD: A Multimethod Longitudinal Analysis

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Background: Temperament refers to relatively consistent dispositions present early in life underlying the expression of activity, reactivity, and emotionality (Goldsmith et al., 1987). Surgency reflects positive affectivity and sociability (Putnam, Gartstein, & Rothbart, 2006). Children at high risk (HR) for autism are reported to exhibit reduced Surgency at 7 and 14 months of age (Clifford et al., 2013), and those later diagnosed with ASD show lower positive anticipation at 24 months (Garon et al., 2009; Zwaigenbaum et al., 2005). Little is known about laboratory-based measures of positive affectivity in infants at risk for ASD or how they compare with parent-reported Surgency.
Objectives: (1) To examine positive affect and Surgency at 6 and 12 months among HR siblings who later develop ASD (HR-ASD), HR siblings without ASD (HR-nASD), and typically-developing LR children (LR-TD); 2) To examine concurrent relationships between lab-based and parent report measures of positive affectivity/Surgency at 6 and 12 months; and 3) To examine group differences on parent-reported Surgency at 18 months.
Methods: 184 infants (HR-ASD, *n*=21; HR-nASD, *n*=104; LR-TD, *n*=59) completed a lab-based measure of positive affectivity at 6 and 12 months and were evaluated for ASD at 24 or 36 months. Parents provided information about their infant's Surgency by completing the Infant Behavior Questionnaire (IBQ; Gartstein, & Rothbart, 2003) at 6 and 12 months and the Early Childhood Behavior Questionnaire (ECBQ; Putnam, Gartstein, & Rothbart, 2006) at 18 months. Examiners administered a series of brief standardized probes (Social Orienting Probes; SOP) designed to elicit positive affect, including speaking in motherese, singing a nursery rhyme, tickling, playing peek-a-boo, and demonstrating a toy. Videotaped sessions were coded offline by blinded coders for the duration of the infants' display of positive affect, standardized over the length of each probe (%PosAffect). Linear mixed models were used to examine the effects of age and diagnostic group on %PosAffect and Surgency at 6 and 12 months. ANOVA was used to examine differences between diagnostic groups on Surgency at 18 months. Pearson correlations were employed to examine concurrent relationships between %PosAffect and Surgency at 6 and 12 months.
Results: Analyses of %PosAffect ($F(1, 313)=20.7$, $p<.001$) and Surgency ($F(1, 260)=19.6$, $p<.001$) both revealed only a main effect of age (6<12months). Diagnostic groups differed significantly on Surgency at 18 months, $F(2, 124)=4.8$, $p=.009$; LR-TD>HR-ASD). Positive affect displayed during the SOP at 12 months was significantly correlated with concurrent Surgency, $r=.20$, $p=.02$, with a trend toward a significant correlation between measures at 6 months, $r=.16$, $p=.09$.
Conclusions: Results indicate that neither positive affect during a live social interaction nor Surgency as reported by parents differed across the three groups at 6 or 12 months, but at 18 months of age, HR-ASD infants displayed lower Surgency than LR-TD infants. Results are largely consistent with the previous literature. We extend this work by showing congruency between parent report of Surgency and an observational measure of positive affectivity. Future research should examine additional aspects of temperament using a multimethod approach.

48 **178.048** Positive and Negative Affective Vocalizations in 2-Year-Olds with ASD

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Background: Research on affect in young children with ASD suggests that they are less socially reactive, smile less, and show more distress reactions than typical peers (Cassel et al., 2011; Zwaigenbaum et al., 2005). Child temperament is particularly important to study because children with difficult temperaments are at increased risk of child abuse and neglect (Fisher, Hodapp, and Dykens, 2008). Plumb and Wetherby (2012) found that infants later diagnosed with ASD produced more non-speech distress vocalizations than developmentally delayed children and typically developing controls. However, the field has yet to conclusively determine whether diagnostic group differences exist in delight and distress sounds (Sheinkopf et al., 2000; Paul et al., 2011; Schoen, Paul, & Chawarska, 2011).
Objectives: Assess whether patterns of non-speech affective vocalization distinguish children in three groups: children who have an older sibling with ASD and are also diagnosed with ASD (ASD); children at high-familial risk for ASD by virtue of having an older sibling with ASD, but not currently diagnosed with ASD themselves (HR-), and children at low-familial risk for ASD with no ASD diagnosis themselves (TDC).
Methods: The Communication and Symbolic Behavior Scales (CSBS; Shumway & Wetherby, 2009) was administered to 33 2-year-olds (ASD: 9, TDC: 12, HR-: 12) participating in the Infant Brain Imaging Study (IBIS; Estes et al., 2015). Two individuals coded child non-speech vocalizations into four categories: (1) delight (laugh), (2) distress (cry, whine, fuss), (3) atypical (squeal, growl, yell, grunt), or (4) other (sound effect, uncodable); ("vegetative" vocalizations like coughs were excluded from the current analyses). For this study, we calculated the percentage of time occupied by distress and delight vocalizations relative to total amount of non-speech vocalization produced by each child.
Results: Â A repeated measures ANOVA with group (ASD/TDC/HR-) as a factor and affective vocalization type (delight/distress) as a repeated measure revealed a trend toward an interaction between group and type, $F(2,29)=3.01$, $p=.065$, $\eta_p^2= .17$ (see Figure 1). Planned paired contrasts revealed that the ASD group produced significantly more distress than delight vocalizations ($p<.05$), the TDC group produced marginally more delight vocalizations than distress vocalizations ($p<.08$), and the HR- group produced equal amounts of each type (p=n.s.). Independent samples t-tests showed the ASD group produced a significantly higher percentage of distress vocalizations (39%) than the TDC group (14%, $p<.05$). In contrast, the TDC group produced a significantly higher percentage of delight vocalizations (43%) as compared to the ASD group (12%, $p<.05$). The HR- group was not significantly different from the other two groups on either variable.
Conclusions: Â Emotion regulation difficulties in ASD are common and impairing (Mazefsky et al., 2013) and dysregulation in toddlers is associated with increased parenting stress (Davis & Carter, 2008). Fine-grained identification of distress vs. delight vocalizations in children's natural communication, demonstrated here, could serve as a way to monitor progress as clinicians and parents help children learn to regulate their emotions. We plan to code distress/delight vocalizations at 6 and 12 months as well, to understand developmental continuity and deviation in this domain (anticipated complete, May 2017).

49 **178.049** Potential Neonatal Neurobehavioral Signs of ASD Risk in Premature Infants

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Background: The prevalence of autism spectrum disorders (ASD) among premature infants is approximately five times greater than the general population. Current assessments have not identified reliable behavioral predictors of ASD risk in early infancy. It is hypothesized that early differences in social attention and responses may be diminished in infants at risk for ASD. Such early indicators of risk for ASD have not yet been investigated in premature infants.
Objectives: To explore the NICU Network Neurobehavioral Scale (NNNS; Lester & Tronick, 2004) as a potential predictor of ASD symptomatology in toddlerhood. The NNNS is a standardized neonatal neurobehavioral assessment that includes specific responses to animate and inanimate stimuli and more general summary scores.
Methods: Participants included 211 families from an 18 month follow-up study of associations between a single family room neonatal intensive care unit (NICU) model of care and infant neurodevelopmental outcome (Lester et al., 2016).Â Infants were all born <36 weeks gestational age (*M* = 27.59, *SD* = 2.27) and <1500 g (*M* = 967.39, *SD* = 240.73). Fifteen percent were from very low SES families. The NNNS was administered prior to NICU discharge (*M* gestational age = 37.75 weeks, *SD* = 4.60). The NNNS includes procedures in which the infant attends to animate (examiner's voice and/or face) and inanimate (rattle/ball) stimuli. The NNNS also includes summary scales describing infants' neurobehavioral status. Participants were seen in our follow-up clinic at 18 months (*M* = 22.44 months (uncorrected), *SD* =1 .68). Follow-up measures included the Pervasive Developmental Disorders Screening Test, a parent-report screening measure of ASD symptoms (PDD-ST; Siegel, 2004), and the Response to Name and Response to Joint Attention items adapted from the Autism Diagnostic Observation Schedule (Lord et al., 2000), a method reported on previously (Stephens et al., 2012). Logistic and linear regressions were used to explore relations between scores on the NNNS and ASD outcome measures with gestational age as a covariate.
Results: Â Logistic regression showed that diminished orientation to voice on the NNNS was related to lack of response to name, $\chi^2 = 10.14$, $p = .04$, OR = 1.48, 95%CI 1.12-1.96, $p = .006$. Analysis of the NNNS summary scores using linear regression showed more non-optimal reflexes were associated with elevated risk scores on the PDD-ST scores, $F(3, 177) = 4.74$, $p = .003$, $\beta = 3.39$, $p = .001$.
Conclusions: Â Results suggest that the NNNS may be related to signs of ASD symptomatology at 18 months in infants born <36 weeks gestational age. The relation between the infant's response to voice on the NNNS and response to name at 18 months could suggest developmental continuity in response to voice, which is often diminished in ASD. The finding that infants with higher scores on the PDD-ST had less optimal reflexes is consistent with atypical motor behaviors in infants later diagnosed with ASD (Bryson et al., 2007). Although this study was limited by use of ASD symptom counts rather than diagnosis, results suggest potential neurobehavioral signs of risk for ASD in early infancy.

50 **178.050** Predictors of Expressive Language Outcome over a Two Year Period in Very Young Pre-Verbal Children with ASD

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Background: Extant research suggests that up to two-thirds of children with ASD who are pre-verbal, or have significantly impaired expressive language in toddlerhood, will develop some degree of functional expressive language by age five (Tager-Flusberg & Kasari, 2013; Thurm et al., 2014). Nonverbal cognitive ability, autism symptom severity, adaptive social functioning, and use of specific social skills such as joint attention in toddlerhood have been associated with expressive language outcomes (i.e., remaining pre-verbal or exhibiting improved expressive language; Thurm et al., 2007).
Objectives: We examined associations between nonverbal cognitive ability, adaptive social functioning, autism symptom severity, and use of joint attention skills in toddlerhood and expressive language ability two years later in a sample of very young pre-verbal children with ASD. We sought to identify baseline indices of child functioning that predicted stability in expressive language impairment versus improved expressive language.
Methods: Participants were 56 children (13 girls) with ASD first assessed at 20 to 33 months (T1; M = 28 ± 4 months) and again two years later (T2; M = 52.8 ± 5 months, range = 43-66). Participants were pre-verbal at first assessment, defined by *t*-scores on the Mullen Scales of Early Learning (Mullen) expressive language scale below 30, which corresponds to the "Very Low" descriptive category. Nonverbal cognitive ability was operationalized with a composite of the Mullen Visual Reception and Fine Motor subscales. Social functioning was assessed by mother-reported Vineland Adaptive Behavior Scales Socialization standard scores. Autism symptom severity was assessed with the Autism Diagnostic Observation Schedule algorithm total score. The Early Social Communication Scales measured joint attention skills, which included response to and initiation of requests, reciprocal social play, and shared attention. Children were assigned to outcome group based on their T2 Expressive Language *t*-score. Children whose scores remained in the Very Low range (*t*-scores ≤30) were assigned to the "remained pre-verbal" group (*N* = 38), and children with Below Average or Average range scores were assigned to the "improved" group (*N* = 18). T1 age was included in analyses as a covariate.
Results: In bivariate analyses, baseline nonverbal cognitive ability, autism symptom severity, social functioning, and T1 age differed significantly by outcome group (*p*s < .05). The "improved" group was younger at T1 and demonstrated higher baseline nonverbal cognitive ability and social functioning and less severe autism symptoms than the "remained pre-verbal" group. Subsequent logistic regression revealed that T1 autism symptom severity significantly predicted group membership ($\beta = -.35$, $p = .002$; OR: .70, CI: .56–.88), as did T1 age ($\beta = -.27$, $p = .007$; OR: .77, CI: .63 –.93).
Conclusions: Â Our results support the role of autism symptom severity in toddlerhood in predicting expressive language outcomes later in childhood (Weismer & Kover, 2015). Contrary to expectations, nonverbal cognitive ability and parent-reported social functioning were unrelated to expressive language outcome, though our power was limited (Thurm et al., 2014). Identifying early predictors of expressive language outcomes can inform much-needed additional research that focuses specifically on individuals with ASD who have limited expressive language.

51 **178.051** Preferential Attention to Audiovisual Synchrony Predicts Language Ability in Toddlers with ASD

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Background: Children with ASD exhibit atypical patterns of visual attention to the social world, responding differently to physical and social contingencies relative to non-autistic peers. In studies examining preferential attention to audiovisual synchrony, we showed that ASD infants are relatively insensitive to social contingencies afforded by talking faces, focusing instead on physical contingencies between light and sound. By manipulating audiovisual stimuli comprising faces and shapes synchronized with speech and tones, we found that TD controls exhibited a preference for synchronous faces and speech, lacking in ASD participants, even though groups did not differ in baseline sensitivity to audiovisual synchrony. In early studies, significant differences were found based on simple measures of visual attention derived from mean relative fixation durations. More recently, we applied techniques from information theory to quantify differences between full probability distributions of eye-tracking trajectories across groups, and derived optimal classifiers based on a generalized likelihood ratio test that achieved sensitivity 79.5% and specificity 97.4% in discriminating ASD infants from TD controls. In evaluating our classifier performance, we noticed that ASD infants with eye-tracking likelihood-ratio scores closer to the typical range appeared to have better language ability, suggesting a potential relationship between sensitivity to audiovisual synchrony and the emergence of spoken language.
Objectives: Our goal was to test whether information-theoretic measures of differences in visual attention to audiovisual synchrony that discriminate between TD and ASD toddlers predict language ability in those children.
Methods: Toddlers with autism (N=34) and typically developing controls (N=20) participated in a simple preferential-looking paradigm based on split-screen presentation of video stimuli (faces and shapes) paired with audio stimuli (speech and tones). Using different combinations of video and audio stimuli, and manipulating audiovisual synchrony between the two, we tested for differences in attention to social and physical contingencies. Eye tracking was used to quantify response. Using machine-learning techniques, we derived optimal measures of overall attention and attention to social target across all stimulus combinations, focusing on responses to speech and non-speech. An optimal classifier was derived using a generalized likelihood ratio test calculated from the entire joint distribution of our measures across groups. Receiver operating characteristics were further used to quantify classification performance, using leave-one-out cross-validation with the log likelihood ratio as the test statistic. To determine the relationship between preferential attention to audiovisual synchrony and language ability, we calculated the correlation between the log likelihood ratio scores and the receptive and expressive language scores determined from clinical assessments using the Mullen Scales of Early Learning.
Results: We found significant correlations ($P<0.05$) between the log likelihood ratio scores (speech/non-speech conditions) and both receptive ($r=-0.332/-0.394$) and expressive ($r=-0.413/-0.409$) language scores.
Conclusions: Patterns of preferential attention to audiovisual synchrony that discriminate between ASD and TD children are also predictive of language ability in those children, suggesting that differential sensitivity to social and physical contingencies in talking faces is a pathway to spoken language in autism.

52 **178.052** Prelinguistic Predictors of 24-Month Expressive Language for Infants at High-Risk for ASD

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Background: Language development for typically developing children occurs in the context of rich social interactions. Precursors of expressive language comprise a repertoire of nonverbal communicative behaviors, including gestures and facial expressions (Bates et al., 1987). Most children with autism spectrum disorder (ASD) experience difficulty with the acquisition and use of language, which has a significant impact on overall level of functioning. Moreover, the majority of high-risk infant siblings of children with ASD also exhibit language atypicalities, presumably indicative of the broader autism phenotype (e.g., Messinger et al., 2013). Identification of prelinguistic predictors of 24-month expressive language outcome could improve early detection of language delays and inform early intervention practices for high-risk siblings.
Objectives: The goals of this study are to: 1) identify prelinguistic predictors of 24-month expressive language outcome for high-risk and low-risk infants, and 2) compare linear regression and random forest methods for identification of predictor variables.
Methods: Participants include 39 high-risk and 56 low-risk infants seen for developmental and social-communication assessments at 12- and 24-months as part of a large, federally-funded longitudinal study examining risk and resilience in the first two years of life. The Communication and Symbolic Behavior Scales (CSBS-DP; Wetherby & Prizant, 2002) is a standardized assessment tool that examines communicative, social-affective, and symbolic abilities, resulting in seven clusters that make up three composites: Social (Emotion/Eye Gaze, Communication, Gestures), Speech (Sounds, Words), and Symbolic (Understanding, Object Use). The CSBS and Mullen Scales of Early Learning were administered at 12- and 24-months for each participant. Univariable and multivariable linear regressions were conducted using the 24-month Mullen Expressive Language T-score as the outcome. Possible predictor variables included: risk status, 12-month Mullen Expressive (EL) and Receptive (RL) Language subdomains, and all CSBS clusters. These results were compared to a random forest approach (a machine learning tool for regression) using the same predictor and outcome variables.
Results: High-risk infants scored significantly lower than low-risk infants on Mullen expressive language at 24-months ($p<.001$). The four most significant predictors resulting from the univariable regression were risk status ($R^2=.19, p<.001$), CSBS Gestures ($R^2=.14, p<.001$), CSBS Communication ($R^2=.11, p<.001$), and CSBS Speech ($R^2=.11, p<.001$). The multivariable regression revealed risk status, CSBS Speech, and CSBS Understanding as most predictive of expressive language ($R^2=.31$, RMSE=11.36). Using random forests, the four most significant predictors were risk status, CSBS Speech, Mullen EL, and Mullen RL, (RMSE=10.96). A Spearman correlation indicated moderate agreement between the regression and random forest approach with regard to significant predictors ($r_s=.53$).
Conclusions: Results suggest several prelinguistic factors that significantly predict 24-month expressive language in high-risk and low-risk infants. There was moderate agreement between the linear regression and random forest approaches. Risk status was by far the most predictive of expressive language at 2-years. Additional significant predictors included gesture use, receptive language, very early speech (i.e., first words), and the overall frequency and function of communication. These results have significant implications for the development of very early intervention strategies that target all forms of communication, including gestures, first words, and receptive language, to promote language development in high-risk infants.

53 **178.053** Longitudinal Examination of Head Control in Infants at High- and Low-Risk for Autism Spectrum Disorder from Two to Six Months

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Background: Toddlers with autism spectrum disorder (ASD) show atypical motor and cognitive development in the first two years of life (Landa et al., 2013). Recently, motor delays have been documented in infants at high-risk for ASD as young as 6-months of age, specifically highlighting head control as an area of concern (Bhat et al., 2012, Flanagan et al., 2012). Prospective, longitudinal measurement of motor milestones, beginning as early as 2-months, will inform early detection methods and support the development of novel interventions for ASD.
Objectives: The goal of this study is to explore differences in the emergence of head control abilities, coordinated with visual and auditory attention, in 2- to 6-month-old infants at high- and low-risk for ASD.
Methods: The *Bayley Scales of Infant and Toddler Development* was administered monthly to infants enrolled in a large, longitudinal, federally funded study at high-risk (HR, N=23) and low-risk (LR, N=15) for ASD at five time points between 2- and 6-months of age. Four items specifically measuring head control were selected from the Bayley and included in the current analysis: follows-ring, turns-to-sound, shifts-attention, and follows-ball. Each item was administered with the infant sitting in the caregiver's lap and required head control in conjunction with visual and/or auditory attention. Chi-square analyses were used to identify differences in reaching each of these milestones at monthly time points from 2- to 6-months of age. Data collection for this study is ongoing and we anticipate an additional 25 participants to be added to the current sample before May, 2017.
Results: Overall, HR infants appeared to meet each milestone later than LR infants. Milestones were considered to be met when 100% of infants within a group demonstrated the behavior. LR infants met the follows-ring milestone at 3-months while HR infants met this milestone at 5-months. There was a marginally significant between-group difference at 3-months ($p=0.07$). The turns-to-sound milestone was achieved at 4-months for LR infants and 5-months for HR infants. No significant differences were observed at a single time point for this item. The shifts-attention milestone was achieved at 4-months for LR infants and 5-months for HR infants, with no observed significant differences between groups at any time point. Finally, results revealed that LR infants met the follows-ball milestone at 4-months, while HR infants met this milestone at 5-months. A marginally significant between-group difference for this item was observed at 2-months ($p=0.1$) and a significant difference was observed at 4-months ($p=0.01$).
Conclusions: This preliminary study is one of the first to provide evidence for very early delays (starting at 2-months) in HR infants' use of head control while attending to visual and auditory stimuli. Identification of early differences in head control, especially when paired with measures of attention, can contribute to our understanding of motor ability within the cascade of developmental and social abnormalities observed in children with ASD. These results could have significant implications for early detection of ASD and the development of early intervention.

54 **178.054** Self-Regulation and Attention from 1-Week to 2-Months of Age in Infants at High- and Low-Risk for ASD

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Background: Infant self-regulation, in the face of highly stimulating or distressing events, emerges in the first months of life. This ability is critical for maintaining alertness, interacting with a caregiver, and attending to the environment. Toddlers with autism spectrum disorder (ASD) experience difficulty with self-regulation, which could interfere with social interaction, communication, and learning (Dodge, 1989; Gomez & Baird, 2005). Previous studies suggest a link between decreased self-regulatory capacities in early infancy and later medical and behavioral problems, including ASD (Liu et al., 2016; Gomez & Baird, 2005). For this reason, high-risk infant siblings of children with ASD may demonstrate a decreased ability to self-regulate in the first few months of life compared to low-risk infants.
Objectives: This exploratory study compared abnormalities in self-regulatory abilities in the first months of life for infants at high- and low-risk for ASD. Specifically, we investigated very early developmental trajectories of 1) excitability, 2) self-regulation, and 3) attention in high-risk and low-risk infants between 1-week and 2-months of age.
Methods: As part of a large, longitudinal, federally funded study, participants included low-risk (LR, N=20) and high-risk (HR, N=19) infants seen at 1-week, 1-month, and 2-months of age. Measures of excitability, regulation, and attention (response to visual and auditory stimuli) were obtained from the *NICU Network Neurobehavioral Scale* (NNNS; Lester & Tronick, 2004) and differences between HR and LR infants were explored. Given the documented relationship between regulation and learning, the *Bayley Scales of Infant and Toddler Development* was administered and associations between Bayley cognitive scores and NNNS regulation scores were also investigated.
Results: Repeated measures two-way ANOVAs were used to analyze trajectories of excitability, self-regulation, and attention across HR and LR infants. There were no differences in excitability between groups at any time point. However, there was a marginally significant interaction ($p=.125$, see Fig 1a) in which LR infants showed a significant decrease in excitability across time ($p=.05$), while HR infants remained stable. In regard to self-regulation, both HR and LR infants made very little change from 1-week to 2-months, however there was a marginally significant difference across groups at 1-month: HR infants demonstrated fewer self-regulatory abilities compared to LR infants ($p=.09$). In contrast to HR infants, LR infants showed steadily increasing attention scores from 1-week to 2-months, resulting in a marginally significant interaction across time and risk group ($p=.122$, see Fig 1b). HR infants showed significantly lower attention scores at 2-months ($p=.010$). Finally, Pearson correlations revealed a positive association between self-regulation ability and Bayley cognitive standard scores at 2-months ($r= .421$, $p<.05$).
Conclusions: Very few studies to date have investigated neurobehavioral differences in HR and LR infants as young as 1-week-old. These preliminary findings provide novel evidence suggesting differences in trajectories of excitability, self-regulation, and attention. Further, these results suggest that self-regulation could be important for early cognitive development. Finally, results reveal that HR infants as a group may be more vulnerable to difficulties in self-regulation and attention when compared to LR infants.

55 **178.055** Prevalence of Four Types of Feeding Problems in Children Under Three with ASD Compared to Children with Language Delay

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Background:
Feeding problems such as selective eating in children with autism spectrum disorder (ASD) have been shown to be higher in prevalence compared to typically developing children and children with other developmental delays (prevalence estimates 46% - 89%, Ledford & Gast (2006)). The majority of studies investigating this have had samples of children over the age of three years. There are some studies that suggest that feeding problems start very early in ASD, but they are either very general in description (Dominick et al., 2007; Olsson et al., 2013), spanned large age ranges without separate analyses for infants and toddlers (Field et al., 2003; Williams et al., 2005), or used children referred specifically to feeding clinics (Williams, Gibbons, & Schreck, 2005). The issue of a comparison group is important, as well, since it will be important to know if children with ASD differ from other children who might be also prone to feeding problems (e.g., children with other disabilities such as language delay). More specific information is available for older children with ASD, showing that children with ASD are selective by a variety of dimensions including food texture, taste or smell, foods mixed together, brands, or food shape (Hubbard et al., 2014).
Objectives: To compare the prevalence of four types of feeding problems for children with ASD under the age of three years, compared to children with non-ASD language delay (LD). Goal 2: To explore demographic variables (gender, age of first evaluation, and neighborhood income) for their associations with the four feeding problems.
Methods: Chart review study of 78 children with ASD and 85 children with Language Delay (LD). Each early intervention chart contained a full psychological and speech-language report. Inter-rater reliability (30% of charts) was found to be excellent, ranging from .62 to .85, for the following feeding problems: food selectivity by texture, food selectivity by food type, refusal to eat new foods, and food over-stuffing.
Results: For each problem, a 2X2 Chi-square analysis showed that children with ASD showed significantly higher prevalence rates than children with LD.Â A 2X2 ANCOVA compared number of children's four feeding problems across diagnosis group (ASD, LD), gender (male, female), with age of first evaluation and neighborhood income serving as covariates. There was a significant gender effect, with male children showing more of the four feeding problems than did female children (male mean = .59, SD = .89; female mean = .16, SD = .43). No significant effects were found for age of first evaluation or neighborhood income.
Conclusions: Results suggest that children with ASD are at significantly greater risk during their first three years of life for each of four types of feeding problems: problems with food texture, and food type, new food refusal, and food over-stuffing. Prevalence rates for feeding problems found for the children with ASD in the present study were similar to those of previous estimates with various types of comparison groups.

56 **178.056** Re-Examining Measures of Risk in the Study of Autism Spectrum Disorder in Infancy

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Background: Autism Spectrum Disorder (ASD) is one of the most highly heritable of all psychiatric disorders, and presents phenotypically with enormous heterogeneity of social, cognitive, adaptive, and behavioral symptoms and levels of functioning. While ASD likely has a genetic etiology, the state of the field limits the ability to prospectively identify genetic risk for the disorder experienced by a given individual. The current study aims to assess the predictive ability of seven factors of birth and early development that have been suggested across the ASD literature to index risk. To assess these factors, the current study adapts a framework outlined by Kraemer et al (1997), identifying ideal attributes of a risk factor to include (1) measurability—the factor's ability to be quantified, (2) precedence—the presence of the factor prior to ASD outcome, (3) usability—the ability of the factor to differentiate among diagnostic outcomes, and (4) potency—the extent to which the factor meaningfully predicts outcome. The present study assesses a range of markers, as they each predict outcome at multiple levels of resolution (*dichotomized* into ASD and non-ASD groups; *categorical,* including Typically-Developing (TD), Broader Autism Phenotype (BAP), and ASD groups; and *dimensional*across level of social disability).
Objectives: The present study will assess the **usability** (binary) and **potency** (continuous) of objective and measurable factors—demonstrating varying levels of precedence—identified as potential markers of infant-experienced risk for the development of autistic social disability.
Methods: Participants were 187 24-month-old infants (113 male, 74 female). The sample was enriched for ASD (96 younger siblings of a child with ASD), and represents a range of gestational age, birthweight, developmental abilities, and diagnostic outcomes (135 TD, 22 BAP, 30 ASD). The Mullen Scales of Early Learning (Mullen), the Vineland Adaptive Behavior Scales (Vineland-II) and the Autism Diagnostic Observation Schedule (ADOS-2) were administered. Diagnostic characterization occurred at 36-months-old.
Results: Multiple of the tested risk factors "failed" the test of usability (Figure 1), not differentiating among diagnostic outcomes (i.e., gestational age and birthweight). Some factors "passed" the test of usability, though demonstrated relatively low potency (Figure 2; i.e., sex and cognitive ability). Sibling Status (presence of an older sibling with ASD), and adaptive ability both demonstrated usability with varying degrees of potency across levels of outcome, though it is of note that Adaptive ability "fails" the test of precedence, emerging alongside symptoms of ASD.
Conclusions: These analyses suggest that there is enormous variability in the degree to which quantifiable factors of infancy and early development are meaningfully predictive of ASD. Further, the current study demonstrates use of a new framework for assessing and understanding such variability, so as to better select and identify risk factors that have predictive utility across multiple levels of diagnostic resolution. While sibling status demonstrates usability and potency across resolutions of diagnostic outcome, 50% of younger siblings of children with ASD go on to develop typically. Thus, there continues to be room for a factor that might index risk experienced by a given child with higher specificity.

57 **178.057** Removal of Electronic Screen Media Viewing in Young Children with ASD: Case Reports

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Background: Higher amounts of television viewing by young children is associated with language, social and cognitive delays. Screen viewing interferes with social interactions that predict positive child development. Many children with ASD watch high amounts of TV and video.
Objectives: To describe the developmental trajectory of three young children with ASD with a history of high amounts of electronic screen media (ESM) viewing, who underwent an ESM fast based on the recommendation of a community provider.
Methods: Review of health and early intervention records of three boys with ASD who decreased ESM viewing beginning at ages 20 to 42 months of age.
Results: Child #1 viewed an average of 4 hours of TV daily, received early intervention at 15 months for language delay, but progressed poorly. Diagnosed with ASD as a 43-month-old, he demonstrated poor eye contact, repetitive spinning and solitary play. After screen removal, eye contact improved, followed by increased social interaction and diminished spinning. He no longer met ASD criteria 9 months after screen reduction with language delay resolving 9 months later. Child #2 viewed 11 hours of children's TV daily since birth. In early intervention since a 17-month-old, he was diagnosed with ASD at 21 months with poor eye contact, no awareness of others, no response to name, sensory avoidance and spun wheels on cars rather than engaging in functional play. Batelle Developmental Inventory (BDI) documented > 2 SD delays in cognitive, communication, and social/emotional development. Two months post screen removal, he acknowledged people, had good eye contact, and used gestures. Two months later, goals of sharing joint attention and following 1-step directions were mastered and he added vocabulary words daily.Â Child #3 was exposed to TV/video 3½ hours daily from age 2 months, increasing to 7 hours daily as a 6-month-old. Early intervention began at 20 months of age for “red flags” of autism with ASD diagnosed at 29 months, with ADOS-2 score of 12. He used few words, avoided eye contact, threw toys instead of functional play, viewed objects of interest in an unusual way, inconsistently responded to name and pulled on parents without eye contact for his needs. Worsening global developmental delay was documented by BDI at age 31 months and goal progress was poor. Over a 4-month period post screen removal, beginning at 36 months of age, he consistently improved his expression of needs and wants from 1.4 to 3.5 out of 4 (rating of 0 to 4 with 0 full prompt and 4 fully initiates). Six months after screen reduction, he has excellent eye contact, fully expresses himself in phrases and and engages in functional and imaginative play with peers. His support services have been reduced.
Conclusions: These cases suggest positive developmental changes related to reduction of ESM exposure in three young children with ASD. Reduction or removal of ESM is unlikely to provide significant risk to a young child. Further research is needed to clarify the relationship between ESM viewing and developmental trajectory in young children with ASD.

58 **178.058** Preserved Play in Females at High Risk for ASD Across the Range of Symptom Severity

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Background: Previous research indicates that the ratio of autism spectrum disorder (ASD) in males to females is 4.3:1 across the full range of intellectual functioning and is even more skewed, 5.5:1, in individuals without comorbid intellectual disability (Fombonne, 2005). Females with similar levels of autism symptomatology as their male counterparts are less likely to receive an ASD diagnosis (Dworzynski et al., 2012). Explanations of this gender disparity include hypotheses about the roles of genetic and biological factors, but their empirical support is inconsistent (Kreiser & White, 2014). Recent work has discussed a potential bias in our conceptualization of ASD as consistent with the symptom profile common in males, while females with ASD may have a different constellation of symptoms. Therefore, further investigation of the bias of the “male autism phenotype” is warranted (Robinson et al, 2013). Symbolic play (i.e. use of imagination to pretend that an object is something else) has previously been implicated in ASD (Lam & Yeung, 2012). However, gender differences in symbolic play in infants and toddlers at high and low risk for ASD have not been sufficiently explored.
Objectives: To examine symbolic play skills in male and female infants and toddlers between 12 and 24 months who are at high risk (HR) and low risk (LR) for developing ASD.
Methods: All children (n= 207, 62.3% males) were administered the Autism Diagnostic Observation Schedule (ADOS-T) by psychologists at 12, 18, and 24 months. ADOS item C2 (Imagination/Creativity) indexed symbolic play; scores range from zero to three, zero indicating well-developed imaginative play skills and three indicating none. HR children were divided into two groups based on their 24-month ADOS calibrated severity score (CSS): HR-Elevated (HR-E; CSS 4-10; n=51) and HR-Non-elevated (HR-NE; CSS 1-3; n=87). LR children all had non-elevated CSS (LR-NE; n=69).
Results: A linear mixed model for item C2 indicated a main effect of ASD severity group ($F(2, 565) = 3.457$, $p = .032$), a main effect of age ($F(2, 565) = 90.061$, $p < .001$), and a main effect of gender ($F(1, 565) = 21.709$, $p < .001$). Pairwise planned contrasts revealed that the LR-NE group had significantly better play skills than the HR-E group ($p = .009$); symbolic play skills improved over time (12-18mo, 18-24mo, 12-24mo) ($ps < .01$), and females displayed more advanced symbolic play than males ($p< .001$).
Conclusions: This study is unique in longitudinally investigating play in infants as young as 12 months and found that females across all ages with both high and low ASD symptom severity showed significantly stronger symbolic play skills than males. Stronger play abilities in females, regardless of ASD symptomatology, may be a factor in the clinical presentation of females with increased autism symptoms. In other words, play skills appear to be relatively preserved in females with elevated ASD symptoms. Future studies should examine the possibility that intact play skills are part of a female autism phenotype.

59 **178.059** Sex Differences in Parental First Concerns for Children Screened at-Risk for ASD

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Background: Â Autism spectrum disorders (ASD) are more prevalent in males than females, with a ratio of approximately 4:1. Furthermore, research suggests that there may be sex differences in early ASD symptomology, with boys exhibiting more readily observable non-verbal impairments and restrictive and repetitive behaviors than girls (Hiller et al., 2015). Due to this more obvious presentation of behaviors in males, ASD may be perceived by parents as being a "boys' diagnosis," which may affect parent report of ASD concerns.
Objectives: Â This study examines whether there are differences in the timing and type of parent report of first concerns between boys and girls who are at-risk for ASD based on the Modified Checklist for Autism in Toddlers (-Revised), with Follow-Up (M-CHAT(-R)/F).
Methods: Â The sample included 532 (N_{male}=373) toddlers considered at-risk for ASD based on the M-CHAT(-R)/F administered during 18- and 24-month well-child visits at pediatricians' offices in metro-Atlanta and Connecticut. Upon comprehensive diagnostic evaluation, 274 (N_{male}=205) were diagnosed with ASD, 226 (N_{male}=150) were diagnosed with a developmental delay, and 32 (N_{male}=18) did not meet criteria for any DSM-IV/5 disorder. Prior to evaluation, parents completed a history questionnaire that included open-ended questions regarding concerns about their child. Parent concerns were coded using a scheme adapted from Ozonoff et al. (2009) into ASD-related concerns (Speech/Communication, Repetitive/Restrictive Behaviors (RRBs), Social, and specific mention of "autism/ASD") and Non-ASD concerns (Motor, Behavior/Temperament, Medical/Regulatory, Feeding/Eating, Disruptive Behavior, and Unspecified). Age and type of first concerns were compared between all boys and girls who were at-risk (i.e., ASD and non-ASD). These were also compared within the ASD group only.
Results: Â For the entire at-risk sample, there was no difference in age of first concern between boys (M=13.76, SD=6.75) and girls (M=13.83, SD=5.57; t(163)=-.057, p=.96); however, parents reported more overall ASD-related concerns in boys (M=1.23, SD=.80) than girls (M=1.05, SD=.72; t(327)=-2.46, p=.014). Parents also expressed concern about RRBs more often for boys (13.7%) than for girls (7.5%; X^2(1, N=532)=4.01, p=.029). Furthermore, parents specifically named "autism/ASD" as a concern more often for boys (5.6%) compared to girls (1.3%; X^2(1, N=532)=5.15, p=.014). In the subsample of children diagnosed with ASD, parents also specifically named "autism/ASD" as a concern more often for boys (7.3%) than girls (0%; X^2(1, N=274)=5.34, p=.011); no other sex differences emerged.
Conclusions: Parents of male toddlers at risk for ASD expressed more ASD-related concerns than parents of female toddlers. Parents of boys reported concern about RRBs and specifically named "autism/ASD" more often than parents of girls. It was notable that no parents of girls who were diagnosed with ASD had named autism/ASD as a specific concern. Thus, parents may not recognize or report concerns about ASD in girls, even though symptoms are clinically significant and warrant diagnosis. In an effort to reduce missed or later diagnosis of ASD in girls, future research should focus on assisting parents in recognizing ASD symptoms in girls to improve the utility of parent-reported ASD concerns in the early diagnosis of ASD, and revising the diagnostic process to account for potential sex differences.

60 **178.060** Sex Differences in Young Children Referred for Autism Spectrum Disorder

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Background: Research has consistently found a sex difference in Autism Spectrum Disorder (ASD), such that boys are 2-5 times more likely to be diagnosed with ASD than girls. Previous studies have suggested that girls, particularly those without comorbid behavior problems or developmental delays, may be less likely to be diagnosed with ASD compared to boys with similar levels of ASD-related symptoms, although this relationship is less clear in toddler and preschool-aged children referred for ASD.
Objectives: (1) To evaluate sex differences in age of referral and age of diagnosis for children under 6 years of age referred due to concerns for ASD; (2) To examine sex differences in cognitive, developmental, and adaptive functioning for young children referred for concerns for ASD and those ultimately diagnosed with ASD; (3) To compare the severity of ASD-symptomology and behavior problems in males and females referred for and diagnosed with ASD.
Methods: Data for the present study comes from a multisite study examining the sensitivity and specificity of a novel smartphone screening tool for ASD. Participants included 230 children between the ages of 18 and 72 months who were referred for evaluation due to concerns for ASD (mean = 40.34 months; SD = 14.88 months). All participants received thorough ASD diagnostic evaluations including clinical interview, demographics, and measures of cognitive/developmental abilities (Mullen or DAS-II), adaptive functioning (Vineland-2), behavior problems (CBCL/TRF), and ASD symptomology via the SRS-2 and ADOS-2. Participants were 80% male, 77% White, 17% Black, 6% Other/Unknown, and 4% Hispanic. Seventy-one percent of participants (164/230) were diagnosed with ASD following the evaluation.
Results: Of the 230 children referred for concerns for ASD, 20% (n = 47) were female. Sixty four percent met DSM-5 criteria for ASD (n = 31), compared to 73% of referred boys who received an ASD diagnosis. Among the full sample of those referred for ASD concerns, girls had equal concerns for ASD on ASD-screening instruments (M-CHAT or SCQ). On average, girls were older at the time of referral than boys (43.18 vs. 39.46 months) and this difference was more pronounced among those subsequently diagnosed with ASD (44.19 vs 38.01 months; $p < 0.05$). Among those who met criteria for ASD, girls had less cognitive impairment ($p < 0.05$), but poorer average adaptive functioning when compared to boys. Among those diagnosed with ASD, boys and girls had similar rates of restricted repetitive behaviors, although there was a non-significant trend for girls to be less likely to have difficulty with transitions and changes in routine ($p = 0.07$).
Conclusions: Few studies have evaluated sex differences in young children referred for concerns of ASD. Although girls and boys presented with similar ASD-related concerns at referral, girls in this study were both referred and diagnosed at later ages compared to boys. There also appear to be a number of differences with respect to cognitive and adaptive behaviors between girls and boys diagnosed with ASD and additional analyses focused on clarifying the differences between boys and girls meeting DSM-5 criteria for ASD are ongoing.

61 **178.061** Social Responsiveness at 12 and 15 Months Predicts Severity of Social Deficits at 4 Years in Infant Siblings

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Background:
Social skills deficits (e.g. joint attention and empathy) that are characteristic of Autism Spectrum Disorder (ASD) emerge early in infancy and are evident before children receive formal diagnoses (Dawson et al., 2004). These early deficits may impact subsequent social skills development (Mundy & Neal, 2001). Therefore, it is important to identify which early deficits, at what age, are related to subsequent social functioning. Understanding if these early social skills deficits predict later social deficits is crucial for building a developmental model of ASD, identifying target areas for intervention, and establishing a timeframe for beginning early interventions.
Objectives:
Identify the extent to which social responses (joint attention skills and responses to examiner's distress) at 12 and 15 months predict the severity of social deficits at four years.
Methods:
Eleven high-risk and 19 low-risk infant siblings were assessed longitudinally at 12 and 15 months of age for: 1) Attention and Affect responses to a standard empathy paradigm (Hutman et al., 2010), 2) Responding to and Initiating Joint Attention (RJA and IJA, respectively; Early Social Communication Scales; Mundy et al., 2003). Additionally, mothers later completed the Social Responsiveness Scale (SRS-2; Constantino, 2012) when infants were 4 years old (mean age= 49.0 months). Linear regressions, with the SRS-2 total severity score (SRS_Total) as the outcome, were conducted separately for RJA, IJA, Attention, and Affect as predictors at each age (12 and 15 months). Risk status was included as an additional predictor in each model to determine if early deficits were predictive of social deficits, beyond known risk effects.
Results:
At 12 months, significant negative effects of Attention ($p<0.001$) and Affect ($p=0.048$) on SRS-2 Total scores were observed. At 15 months, significant negative effects of Attention ($p=0.005$) and RJA ($p=0.046$) and a marginally significant effect of Affect ($p=0.056$) on SRS-2 Total scores were observed. These findings suggest that infants who paid less attention to the examiner in distress at 12 and/or 15 months, who displayed less affect towards the examiner in distress at 12 and/or 15 months, and/or who failed to respond to the examiner's request for joint attention at 15 months were reportedly exhibiting greater social deficits at 4 years.
Conclusions:
Consistent with theory, the results of our study indicate that observed social deficits in infancy predicted parent report of social deficits in early childhood. Specifically, we found that failing to respond to either a social partner's: (1) distress, or (2) attention significantly predicted greater social impairment 3 years later. Our data would suggest that any early failures to respond to social partner may be important markers of social developmental risk that should be closely monitored and/or be considered intervention targets.

62 **178.062** Stability of Temperament in Children with Autism Spectrum Disorder, Developmental Delays, and Typical Development: A Brief Longitudinal Study

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Background: Previous research suggests that children with Autism Spectrum Disorder (ASD) demonstrate differences in temperament development when compared to typically-developing children (TD). To date, no study has examined temperament development over time in children with ASD.
Objectives: To examine temperament changes in preschool children with ASD, developmental delays (DD), and TD, using parent report during two assessments.
Methods: We included children with ASD (n=37), DD (n=29), and TD (n=27). Children were administered the Mullen Scales of Early Learning (MSEL), and the Autism Diagnostic Observation Schedule (ADOS) at time 1. Parents completed the Carey Temperament Scales (CTS) at time1 and time 2. We compared parents rating of different temperament items on the CTS between time 1 and time 2.
Results: At time 1, children with ASD were rated as less distractible ($F(2.00, 89.00)=27.039$, $p<0.001$), and adaptable ($F(2.00, 89.00)=9.073$, $p<0.001$), as well as more emotionally negative ($F(2.00, 89.00)=10.213$, $p<0.001$) when compared to their TD and DD peers. Children with ASD were also perceived as more withdrawn (i.e., approach) and intense than their TD peers only, respectively ($F(2.00, 89.00)=7.217$, $p=0.001$; $F(2.00, 89.00)=5.131$, $p<0.005$). At time 2, the ASD group was rated differently on all dimensions, except intensity. Specifically, children with ASD were perceived as more active ($F(2.00, 65.00)=12.791$, $p=0.001$), less biologically rhythmic ($F(2.00, 65.00)=7.889$, $p<0.001$), more withdrawn ($F(2.00, 65.00)=13.765$, $p<0.001$), less adaptable ($F(2.00, 65.00)=13.625$, $p=0.051$), more emotionally negative ($F(2.00, 65.00)=5.391$, $p<0.050$), less persistent ($F(2.00, 65.00)=8.591$, $p<0.001$), and less distractible ($F(2.00, 65.00)=11.424$, $p<0.001$), than the TD and DD groups. They were also described as less reactive to their environment than their TD peers only ($F(2.00, 65.00)=4.983$, $p=0.010$). Additionally, the DD group was rated less active ($F(2.00, 65.00)=12.791$, $p=0.001$), adaptable ($F(2.00, 65.00)=13.625$, $p=0.051$), and reactive ($F(2.00, 65.00)=4.983$, $p=0.010$) than the TD group. Regarding temperament development overtime, parent ratings did not change between time 1 and time 2 in the TD group, but ratings varied substantially in the ASD or DD groups. Specifically, at time 1, results showed that in the ASD group only activity ($r=.60$, $p<.001$) and approach ($r=.53$, $p<.001$) were significantly associated to their corresponding dimensions at time 2. However, in the TD group, rhythmicity ($r=.51$, $p<.050$), approach ($r=.75$, $p<.001$), intensity ($r=.81$, $p<.001$), and mood ($r=.60$, $p<.050$) at time 1 were significantly associated to their corresponding dimensions at time 2. No associations were found in the DD group.
Conclusions: Overall, children with ASD were often viewed as having more temperamental difficulties than their typically developing peers, as well as their developmentally delayed peers. Unlike children with ASD, the TD group showed less cross-time variability in their temperament. These findings indicate that children with ASD and developmental delays might have a different developmental trajectory than children with typical development as it relates to temperament. Results of this study are also informative to clinicians and researchers and suggest the need to assess and provide interventions related to temperament problems in children with ASD.

63 **178.063** Studying Heart Rate Differences during Social Stimuli in Infants at Risk for ASD and ADHD

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Background: Behavioural difficulties in Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD) have been linked to atypical functioning of the autonomic nervous system (ANS). Hyper-arousal in ASD during social situations has been proposed to underlie the differences found in attention to faces. Conversely, inattention and hyperactivity in ADHD have been related to hypo-arousal in response to stimuli. The influence of the ANS during the emergence of behavioural differences in early childhood is unclear.
Objectives: The aim of this study is to see if 5-month-old infants at risk for ASD and ADHD show differences in their heart rate to social and non-social videos compared to low-risk infants. Additionally, we were interested if there are group differences in heart rate changes during the separate videos.
Methods: This preliminary data is part of BASIS (British Autism Study of Infant Siblings – www.basisnetwork.org), a longitudinal study following 5- month old infants at high familial risk for ASD (*N* = 34) and ADHD (*N* = 10) due to having an older sibling with ASD or sibling or parent with ADHD. They are compared to low-risk infants that have an older sibling but no first-degree relatives with ASD or ADHD (*N* = 18). Heart rate was measured continuously during an eye-tracking paradigm, starting and ending with a non-social video (*NS1* and *NS2*). In between, two social videos were presented (*Happy* and *Sad*), counterbalanced in order. Average heart rate and changes throughout the duration of the videos were compared between groups using repeated measures ANOVAs.
Results: There is a significant effect of video type ($F(2.44, 109.57) = 5.15$, $p = .004$, $\eta_p^2 = .10$). Average heart rate is lower during *NS1* compared to *Happy*, *Sad* and *NS2*. The other three videos did not differ from each other. There are no group differences or interaction effects. For the *NS1*, *Happy* and *Sad* videos there is a significant effect of time (*NS1*: $F(3.89, 229.28) = 5.88$, $p < .001$, $\eta_p^2 = .09$; *Happy*: $F(3.09, 151.24) = 3.33$, $p = .020$, $\eta_p^2 = .06$; *Sad*: $F(3.76, 195.67) = 4.09$, $p = .004$, $\eta_p^2 = .07$). Within-subject contrasts show that heart rate decelerates in the first 5 seconds and accelerates between 15-25 seconds. There is no significant effect of group or interaction effects.
Conclusions: This preliminary data shows that infants at low and high risk for ASD and ADHD are comparable in average heart rate and heart rate changes in response to social and non-social videos. All groups show an initial deceleration in heart rate during three of the videos, consistent with literature on deceleration in response to orienting and attention. The acceleration in heart rate can be interpreted as the termination of attention or an increase in stress. Later time points need to be considered to see if and when physiological differences emerge in development and whether they relate to later-emerging behavioural atypicalities.

64 **178.064** Studying Symptom Onset and Intervention for Infant Siblings of Children Diagnosed with Autism

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Background**:**
About 20 percent of infant siblings of ASD children will be diagnosed with ASD by age three. (Brian et al., 2014; Ozonoff et al., 2011). Symptoms of ASD are present during the first two years of life, and reflect aberrant brain activation (Brian et al., 2014; Jones and Klin, 2013; Landa et al., 2012), which may be normalized by learning new responses to environmental stimulation, including human interaction (e.g., Helt, et al., 2008; Xu et al., 2009). By intervening before the full syndrome is present, at risk children may avoid being diagnosed (Rogers et al., 2008). Using ABA, ESDM or other strategies, several studies have found improvement in at risk children under two years old (MacDonald et al., 2004; Rogers et al., 2010, 2014**).**
Objectives:
1. Determine the earliest signs of symptomatic behavior including delays and loss of skills during the first six months of life in infant siblings.
2. Describe the response to intensive intervention with symptomatic infants and their parents.
Methods:
Parents of infant siblings gave informed consent. Infants were assessed using the AOSI (Bryson et al., 2000), Bayley III, the Mullen, the PLS-5, and the Vineland. Development was followed weekly throughout intervention. Intervention followed developmental, ABA and ESDM strategies, coupled with family counseling and training for parents. Intervention ranged from 15 to 40 hours weekly. Parents attended with their infants, which allowed us to do direct coaching. Staffing of the intervention room was 1:1.
Results:
1. Of the 75 infants, ranging in initial age from 6 days to 7.5 mos (mean 2.5 mos), 13 were identified as showing symptoms of ASD (20.3%), and 11 were typical developing (TD). Symptoms included poor eye contact, reactivity, fleeting attention and engagement with us, flat affect with no smiling, low response to physical interaction, staring off, preferring objects to human interaction, repetitive toy play, poor self-soothing, and rigidity/ fear of novelty, e.g., new toys or people.
2. TD infants showed no losses of raw score points during the first six months. By comparison, symptomatic infants showed delays beginning at 16 days to 2 mos (mean 1.2 mos), and losses of raw score points beginning at 16 days to 5 months (mean 2.6 mos). Most children with losses had 3-4 during the first 6 months, while 2 had 20 losses. The duration of losses was 1 to 2.5 weeks. Losses represented all areas: motor, language, cognitive and social skills.
3. Parents needed coaching to become more attentive, interactive, positive and sensitive to their infant's cues (Wan et al., 2013).
Conclusions:
Early symptoms including loss of skills in all areas occurred during the first one or two months of age. In spite of showing early delays and loss of skill, all infants responded well to intervention.Â Progress was somewhat uneven, with periods of rapid learning followed by plateaus for a week or so, followed by resumption of gains. So far, the 13 infants who showed ASD symptoms, no longer do so. However, since only two are now 2 years old, these results are preliminary.

65 **178.065** Systematic Review of Comorbid Symptomatology and Challenging Behaviors in Infants and Toddlers with Autism Spectrum Disorder

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Background:
Children with Autism Spectrum Disorder have high rates of co-occurring emotional and behavioral disorders, often contributing to impairments in learning and development. As the field moves toward earlier diagnosis, many of these co-occurring behaviors appear and require treatment in toddlers and very young children. Clinicians often refer to these as co-occurring psychiatric disorders, challenging behaviors, or both interchangeably due to inconsistencies in theories on comorbidities in children this young. It is important to have a clearer picture of the composition of these concerning behaviors in order to successfully intervene.
Objectives:
This study will examine the utility of comorbid diagnoses in very young children with ASD to determine if this is an appropriate term for a toddler and the validity and efficacy of labeling challenging behaviors. In addition, this study will categorize and summarize the prevalence data of comorbid symptomatology and challenging behaviors in multiple samples of toddlers with ASD.Â
Methods:
A range of medical, educational and scientific databases were searched to identify studies of comorbidity and challenging behaviors in toddlers with ASD (i.e., Medline, PSYCHinfo and Education Research Complete). The search was limited to peer-review articles published in English from 1990 to 2016. We searched with the following terms: Psychopathology OR challenging behavior OR problem behavior –AND Infants OR toddlers OR young children –AND Autism OR ASD. Additional searches were performed including terms for each comorbid symptom and group of challenging behaviors (including 'ADHD' 'Hyperactivity' 'Anxiety' 'Aggression' 'Self-Injury' and 'Stereotypy') to attempt to identify all possible studies.Â A combined 415 results were found through these three search engines. References of identified studies were searched and relevant studies included.A total of 34 articles met criteria and were included in this review.Â
Results:
Studies reporting total prevalence of challenging behaviors and/or comorbid symptoms of psychopathology estimate between 15.9% and 46.2% of infants and toddlers with ASD have at least one clinically significant area (Eisenhower, Baker & Blacher, 2005; Hartley, Sikora & McCoy, 2008; Rojahn et al., 2009;. Matson, Fodstad, Mahan & Sevin, 2009). Most frequently reported behaviors include externalizing symptoms such as physical aggression, disruptive/tantrum behaviors and ADHD symptoms such as inattention and impulsivity. Much less data is available on internalizing symptoms in toddlers such as depression/withdrawal symptoms. Additionally, demographic differences were reported regarding race, age and sex.
Conclusions:
Challenging behaviors in toddlers with ASD present in a wide variety of ways. Evidence is mixed for making a formal psychiatric diagnosis in toddlers as co-morbidities in very young children are often unstable. Despite this, it is clear from this review that many that toddlers with ASD present with significant amounts of challenging behavior which could likely benefit from intervention. Implications for diagnostic practices are discussed along with needed areas of future research.

66 **178.066** Tactile Sensory Gating in Infant Siblings of Children with ASD or ADHD and Age-Matched Controls

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Background: Atypical responses to sensory stimuli, in the forms of hypersensitivity and hyposensitivity, are commonly observed in individuals diagnosed with ASD and ADHD (Schauder & Bennetto, 2016) but have rarely been contrasted in experimental studies. Given the genetic overlap between the two diagnoses, investigating similarities and differences in early sensory symptomatology may help in unraveling shared/unshared developmental pathways (Johnson & al., 2015). Inefficient filtering of environmental stimulation ("sensory gating") has been proposed as a cause of the sensory abnormalities observed in children with ASD/ADHD, and previously measured by employing ERP auditory gating paradigms (Orekhova et al., 2008; Orekhova & Stroganova, 2014).
Objectives: This study investigated behavioral and neural mechanisms mediating tactile sensory gating in three groups of 10-month-olds: infants at familial risk of ASD (*N*=49), infants at familial risk of ADHD (*N*=17) and age-matched controls (*N*=22). We expected to observe greater variability in contingent behavioral responses and reduced habituation to tactile stimulation in at-risk infants. These results would support research indicating that both hypersensitivity and hyposensitivity occur in individuals diagnosed with ASD and ADHD. Additionally, they would point to impairments in habituation mechanisms occurring in these disorders. From a neural perspective, we predicted to observe sensory gating deficits in at-risk infants. These results would extend previous research employing ERP auditory paradigms indicating that sensory gating abnormalities are indexed by neural aberrations in atypical cohorts.
Methods: 10-month-old infants were tested with a paired-stimulus paradigm: 100 ms pairs of vibro-tactile stimuli (S1-S2) with 700 ms ISI within the pair and 8 seconds ISI between the pairs. Stimuli were delivered through headphones placed to the infants' feet: 38 pairs were administered during 2 blocks lasting 4 minutes each. Infants' behavior (looking, moving) was scored during the "anticipation phase" (4 seconds before S1) and the "reactive phase" (4 seconds after S2). Continuous scalp EEG was recorded, the mean amplitude of ERPs time-locked to vibrotactile stimulation was extracted from four electrode pools.
Results: Analysis of behavioral data revealed a main effect of stimulation time (p<.0001) in all groups, indicating that infants' mean behavioral reactivity was higher during the "reactive phase" as compared to the "anticipation phase". Moreover, all groups exhibited habituation effects (1st half vs. 2nd half, p<.001). Analysis of ERPs mean amplitude revealed a main effect of stimulus (S1 vs. S2, p<.05) in the central and inferior parietal pools, indicating that efficient sensory gating occurred in the three groups.
Conclusions: Our findings suggest that behavioral and neural mechanisms mediating tactile sensory gating in infants at familial risk of ASD and ADHD are not significantly different from those observed in age-matched controls. In spite of typical behavioral reactivity and decrease amplitude of ERPs with stimulus repetition, other neural indexes may be atypical in at-risk cohorts (i.e., lateralization of responses, ongoing EEG power). Future analyses will be implemented to compare these indexes and characterize possible risk markers across the three groups.

67 **178.067** Temperament As a Predictor of Anxiety in High-Risk Infants

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Background: Fragile X syndrome (FXS) is a monogenetic disorder characterized by intellectual disability and is the leading known heritable genetic cause of autism spectrum disorder (ASD), which makes it an ideal model for studying ASD. High rates of anxiety have been reported in both FXS and ASD with features of anxiety and ASD overlapping. Specific infant temperament profiles characterized by elevated negative affect have been associated with later emerging anxiety in typically developing and FXS samples and may be predictive of later anxiety in ASD (Tonnsen et al 2013). Despite the high association of anxiety in these disorders, no studies have examined relationships of temperament to anxiety using a cross-syndrome approach. Understanding early features and the trajectory of anxiety symptoms is critical to direct early, targeted treatments to reduce or prevent the occurrence of anxiety in these populations.
Objectives: The purpose of this study is to characterize the emergence of anxiety disorders in high risk infant populations; infants with FXS or ASD siblings contrasted to low-risk controls with two primary questions:

1. What is the prevalence of anxiety symptoms in 24-month-olds with FXS, ASD siblings, and TD controls?Â
2. Does negative affect at 12 months predict anxiety symptoms at 24-months in FXS contrasted to ASD siblings and low risk infants covarying for developmental level?

Methods: We used a prospective longitudinal design. Participants included 31 infants with FXS, 31 ASD siblings, and 37 low-risk controls. The Negative Affect cluster of the Rothbart-Infant Behavioral Questionnaire (IBQ), a parent measure of infant temperament, was completed at 12-months. The Child Behavior Checklist (CBCL) 1.5 – 5 years old Anxiety Problems Subscale, a DSM oriented scale of anxiety, was completed at 24 months. The Early Learning Composite (ELC) of the Mullen Scales of Early Learning, a measure of broad development, was completed at both age points.
Results: A one-way ANOVA showed that the CBCL Anxiety scores for the FXS group were significantly higher than both the ASD siblings (p=.006) and low risk controls (p=.004). A linear regression showed a significant main effect for group and Negative Affect predicting anxiety at 24 months when ELC is covaried (F(2, 62)=2.25, p=.049). Correlations for each group showed a moderate, positive relationship between Negative Affect and anxiety symptoms for infants with FXS (r(18) = .40, p=.086).
Conclusions: This is the first study to compare anxiety symptomatology across infants at high and low risk for anxiety and ASD. Further, this is also the first study to use temperament as a predictor of anxiety symptoms at 24 months of age. Results suggest that the FXS group has elevated anxiety symptomology strongly correlated with negative affect that is distinct from the ASIB group, which indicates potential etiologically distinct profiles of the relationship of early temperament to anxiety or ASD in high-risk groups.Â Temperament characterized by negative affect may impair infants' responses to the environment, reducing positive interaction and resulting in greater emergence of anxiety.

68 **178.068** The Guided Participation Relationship and Parental Tutoring Strategies in Preschoolers with Autism.

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Background:
In a Guided Participation Relationship, parents scaffold children's performance during instructional activity to promote feelings of competence and autonomy (Rogoff, Ellis, & Gardner, 1984). Parents provide such support within their children's Zone of Proximal Development (Vygotsky, 1978). However, not all parents are equally effective as tutors. Mothers of securely attached preschool children are more effective tutors, in that they provide more positive feedback, are less likely to intervene physically, provide help when asked, and pitch their help at an appropriate level for the child's needs (Meins, 1997).Â Feedback and responsiveness from their children help parents provide appropriate levels of scaffolding, encourage motivation, and support transfer of responsibility. Children with autism and their caregivers show difficulties negotiating the Guided Participation Relationship (Beurkens, Hobson, & Hobson, 2013).
Objectives:
The first aim of this study was to compare matched groups of young children with and without autism on a parental tutoring task. Our second aim was to ascertain whether the parental tutoring task revealed patterns of change in a subset of the children with autism, those who (with their parents) received an intervention designed to foster the Guided Participation Relationship (Relationship Development Intervention, RDI).
Methods:
The study included 32 children, between the ages of 3 - 6 years, and their parents. There were 16 children (8 girls) who were diagnosed with developmental disabilities but did not show features of autism, and a matched group of 16 children (7 girls) with a previous diagnosis of autism. At the beginning of the school-year, children were administered the ADOS, a parental tutoring task, and a language assessment. The children with autism were in two separate classes (each class n = 8) in the same preschool. One of the classes added RDI to the daily curriculum. RDI was delivered within the classroom, and via parent sessions provided on site throughout the school year. At the end of the school year, all of the children with autism (and their parents) were assessed again, with the ADOS, tutoring task, and a language assessment.
Parental scaffolding on the tutoring task was coded using Meins (1997) coding scheme (i.e. type and specificity of parent intervention, child sensitivity to feedback, child success, parent response).
Results:
By way of illustration, parents of children with ASD used more spontaneous non-verbal intrusions (ASD=14.85 (2.78), DD=8.30 (0.51), Mann Whitney U=28, p=.021), and more verbal utterances with a physical component (U=23.00, p=.009). Parents in both groups were similar in their sensitivity to the child's success (i.e. adjusted their feedback accordingly). We will provide additional data on child sensitivity to feedback, and changes over time.
Conclusions:
Results of the present study suggest that parents of children with autism do appear to be sensitive to their child's ability level and adjust their interventions accordingly. On the other hand, physical intervention may be required more often for children with ASD, which is consistent with previous literature. Further results may reveal improvements in the guided participation relationship when this is a treatment focus.

69 **178.069** The Quantitative Checklist for Autism in Toddlers (QCHAT): Validation of a Screening Instrument in Italy.

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Background:
Early screening and detection of autism spectrum disorders (ASD) is crucial to enable early effective interventions and to improve long-term outcomes. Several studies in the past two decades have focused on the development of early ASD screening tools that have been tested in both the general population and at-risk children, in population-based and clinically-referred samples. The Quantitative CHecklist for Autism in Toddlers (QCHAT) is a parent-report questionnaire that quantifies autistic traits along a continuum at 18-30 months (Allison et al., J Autism Dev Disord 2008). The QCHAT discriminated between a group of unselected children and those having a diagnosis of ASD. Furthermore it showed that autistic traits are continuously distributed in the general population of toddlers.
Objectives:
To examine the distribution of Q-CHAT scores in (a) an unselected sample of toddlers (TD), (b) in a sample of toddlers and young children with Developmental Delay (DD), and (c) in a sample of young children already diagnosed with an ASD, in three regions (Piemonte, Toscana and Sicilia), representative of the North, Centre and South of Italy.
Methods:
A group of n=318 children took part in the study and the QCHAT was administered. These comprised n=129 TD children (mean age=32.9, SD=9.4 months), n=50 DD children (mean age=27.6, SD=8.3 months), and n=139 ASD children (mean age=31.6, SD=8 months). TD children were recruited in mainstream nursery schools in the three regions involved in the study. ASD and DD children were tested at the clinical facilities within the Autism Centre of the NHS in the province of Cuneo (Piemonte), the Scientific Foundation "Stella Maris" in Pisa (Toscana) and the University Hospital "G. Martino" in Messina (Sicilia) respectively. The Autism Diagnostic Observation Schedule - Second Edition (ADOS-2) and the Griffith's Mental Development Scale (GMDS) were used as part of the diagnostic assessment in the DD and ASD groups. The three groups were matched for age and no region differences were found for age, gender, and QCHAT total scores. A between group analysis of variance was conducted to assess group differences in the QCHAT total scores, accounting for gender effects and gender by group interaction. No differences in Developmental Quotient scores were found in the ASD and DD groups ($F(2,196)=1.66$, $p<0.2$).
Results:
A main effect of group was observed on the QCHAT scores, with the ASD group (mean = 39.4 (SD = 13.1)) scoring significantly higher than the DD (mean = 27.1 (SD = 6.3) and TD (mean = 21.1 (SD = 6.6) group respectively ($F(2,312) = 76.4$, $p<0.001$). No gender and group by gender interaction was found ($F(1,312)=0.62$, $p=0.4$ and $F(2,312)=0.01$, $p=0.99$).
Conclusions:
The QCHAT was able to discriminate between a group of young children with a diagnosis of an ASD and unselected children, as well as between children with developmental delay. This replicates previous findings in a different cultural setting. A large-scale population-based screening study in different regions of Italy is underway to assess the validity of the Q-CHAT as a screening instrument for ASD.

70 **178.070** The Relationship of Early Childhood Characteristics to Autism Severity at School Age

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Background: Children with autism spectrum disorder (ASD) are diagnosed at increasingly early ages (prior to age 3). It is widely known that outcomes vary widely; some toddlers diagnosed with ASD improve greatly as they age, while others continue to experience severe challenges. However, the symptoms most predictive of the future presence and severity of the disorder in later childhood are not well understood. The present longitudinal study explored early predictors of later autism severity and adaptive behavior.
Objectives: The present study explored the relationship of early symptoms and developmental level to the later presentation of the disorder. Specifically, we examined the relationship of ASD symptom severity and adaptive behavior scores at diagnosis (prior to age 3), gender, and age of diagnosis, to symptom severity and adaptive behavior scores at follow-up (school age).
Methods: This longitudinal study examined 70 children who were diagnosed with ASD prior to age 3 (Time 1) and who were 7 years or older (Time 2) (range 7-16 years). The participants were identified from review of early intervention clinical charts at a University Center for Excellence in Disabilities. Approximately half the children were diagnosed before age 24 months. Time 1 data were extracted from early intervention charts, and included: age at diagnosis, sex, and scores from the Vineland Adaptive Behavior Scales (VABS I & II) and the Childhood Autism Rating Scale (CARS). Parents who agreed to participate were mailed a packet containing a consent form, the Gilliam Autism Rating Scale (GARS-3), the Social Communication Questionnaire-Current (SCQ-C) and an extensive parent questionnaire. Once the packet was returned, a phone call was made to administer the VABS- II. Based on the parental responses, GARS-3, SCQ-C, and the VABS-II Daily Living Skills score, participants were divided into one of the three diagnostic/disability categories: ASD with moderate to severe disability, ASD with mild disability, and no ASD diagnosis (but may have had other diagnoses such as learning disabilities and ADHD).
Results: Data were analyzed using ANOVA, ANCOVA, and correlations. In terms of the three diagnostic categories at school-age, 52.2% retained a diagnosis of ASD with moderate to severe developmental disability, 29.0% continued to exhibit ASD with milder disability, and 18.8% no longer met diagnostic criteria for ASD. Autism symptoms at Time 1 were significantly associated symptoms at Time 2 for measures of core ASD symptoms and adaptive behavior. However, early socialization scores were most predictive of both later adaptive behavior scores (Adaptive Behavior Composite, Communication, Socialization Vineland Subscales) as well as later autism severity (GARS total, GARS social, and GARS RRB). As well, the CARS Hyperactivity item was differentially strongly associated with later symptom severity.
Conclusions: Several variables predict later functioning in children with early diagnoses of ASD. Socialization scores were predictive of both later adaptive functioning and autism severity at follow up, as was the single CARS item of hyperactivity, demonstrating continuity in child functioning features over several years. The significant relationships and continuity is striking, given that in this data set, from 4 to over ten years have lapsed since the measurements were taken.

71 **178.071** To Help or Not to Help: Prosocial Motivation in Children at Risk for Autism Spectrum Disorder

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Background: The social motivation hypothesis of autism spectrum disorder (ASD) posits that decreased social motivation in ASD may result in less attention to and thus fewer experiences with social sources of information, negatively influencing the development of social cognition and social-communicative abilities (Chevallier et al., 2012). As this reduction in social motivation is considered to be an etiological factor in ASD, we should be able to observe this difference early in life. However, the diagnosis of ASD can only be reliably made around the age of 2 to 3 years (Charman & Baird, 2008).
Younger siblings of children with an ASD have a 10 to 20 times higher risk of developing ASD themselves and are likely to share some behavioral characteristics with their older sibling (Szatmari et al., 2004). Therefore, the current study focused on intrinsically socially motivated behavior of these 'high-risk (HR) siblings', by administering helping tasks.
Objectives: The current study aims to extend our understanding of (pro)social motivation in HR siblings. Two research questions were formulated:
1. Is there a difference in helping behavior between high-risk and low-risk infants?
2. Is helping behavior associated with social-communicative abilities?
Methods: 24 HR siblings and 34 siblings of typically developing children (low-risk (LR) siblings), participating in a prospective study design, were tested in six helping tasks (Warneken & Tomasello, 2006, 2007) at 24 months of age. In the *experimental condition* (3 tasks) the researcher accidentally encountered a problem that she could not solve herself without the help of the child. In the *control condition* (the other 3 tasks, counterbalanced) a similar situation was created intentionally by the researcher and thus no help was needed. All sessions were videotaped and coded with regard to helping behavior and eye contact to the parent and researcher. Furthermore, the Autism Diagnostic Observation Schedule, Toddler module (ADOS-T; Lord et al., 2013) was administered.
Results: All participants helped more frequently in the experimental compared to the control condition, which suggests that the experimental manipulation was successful.
Second, a significant condition x group interaction showed that HR siblings helped less in the experimental condition than the LR infants. Their helping reactions were also slower. Furthermore, LR siblings made more eye contact with the researcher and parent in the control condition compared to the experimental condition, while there was no effect of condition on eye contact of HR siblings.
Finally, within the total sample, more frequent and faster helping behavior in the experimental condition was associated with lower ADOS-T social affect and total scores.
Conclusions: Given the less frequent and slower helping reactions of HR siblings, it is possible that also children at risk for ASD show lower levels of (pro)social motivation. Furthermore, we found evidence for less social referencing in the ambiguous control conditions in the HR group. LR infants checked more often with the parent and researcher during this strange social situation. Finally, frequency and speed of helping behavior was clearly related with social-communicative abilities in early development.

72 **178.072** To Test or Not to Test: Parents' Perspectives on Infant Sibling Studies in Autism Spectrum Disorders

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Background:
Longitudinal studies of younger siblings of children on the autism spectrum are important as they may point to potentially malleable behavioral and brain processes associated with the later emergence of symptoms. Yet, ethical discussions around such sibling studies are not well-developed. In particular, a better understanding of the potential risks and disadvantages for participating families is needed in order to accurately evaluate the benefit-risk ratio.
Objectives:
We investigated parents' perspectives on participating in an infant siblings study in order to assess possible risks, disadvantages and concerns for participating families. This study builds on previous findings using a larger sample.
Methods:
Questionnaire data was obtained from a total of 79 parents (65% participation) after completion of at least three visits. The data collection was part of an ongoing longitudinal study following infant siblings from 5 months of age to 72 months. Infant siblings had either an older sibling on the autism spectrum or an older neurotypical sibling. During the visits families underwent multiple measures and assessments including eye-tracking, motion-tracking, parent-child-interaction, EEG and MRI. Families typically spent 4-5 h in the lab. The questionnaire examined parents' attitudes towards participating in an infant sibling study, assessed parents' satisfaction and motivation, and explored how parents perceived the child's satisfaction with the study.
Results:
The responses from parents indicated a high level of satisfaction with study participation, both from their own (87%), and the envisaged child perspective (72%). In open comments, parents emphasized the importance and meaningfulness of studying early trajectories in atypical development and a majority strongly recommended other families to participate (89%). No parent expressed complaints about experimental measures or growing concerns for the child's development due to study participation, rather parents expressed appreciation of getting early feedback and advice concerning their child's development. However, the many questionnaires used in the study and long testing days were perceived as a burden for the parents.
Conclusions:
Studying infant siblings of children on the autism spectrum provides important scientific knowledge about the early development of neurodevelopmental disorders. Assessing early precursors and illuminating differential pathways on the autism spectrum is likely to facilitate early diagnosis and intervention. Although our data are based on participating parents only, they suggest that infant sibling studies have a favorable benefit-risk ratio, which is informative for future ethical discussions.

73 **178.073** Trajectories of Cognitive Development in Toddlers at-Risk for Autism Due to Language Delays

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Background: Toddlers with early language delays (LD) demonstrate variable outcomes, with some improving enough to “catch up,” and others developing a variety of disorders, including autism spectrum disorder (ASD; Miniscalco et al., 2006). Cognitive growth in other at-risk infants (siblings of children with ASD) is variable, but is often delayed (Brian, et al., 2014; Landa, & Garrett-Mayer, 2006; Landa et al., 2012; Estes et al., 2015). Less is known about cognitive development in toddlers at-risk for ASD due to early LD.
Objectives: Â The aim of the present study was to examine the trajectories of both nonverbal and verbal cognitive development in toddlers with significant LD compared to TD, and investigate patterns of cognitive development in relation to outcome classification.
Methods: Data were combined from two longitudinal studies of language delay conducted at the National Institute of Mental Health and the University of Utah (n=91). Cognitive assessment included administration of the Mullen Scales of Early Learning (MSEL) at approximately 18 months of age. Dependent on MSEL language scores and history of delay, toddlers were categorized in to two groups: At-risk for ASD due to significant LD (N=30), or TD (N=61). Follow-up visits occurred at approximately 24 and 36 months. Growth mixture models (GMM) explored heterogeneity in cognitive development. In the full sample, a series of increasingly complex GMM were fitted and up to five classes were enumerated. Based on several fit indices and interpretability, the best solution was selected, and class membership was evaluated as a predictor of outcome grouping: No delays, non-spectrum delay, or ASD.
Results: The best-fitting models for nonverbal mental age (NVMA) and verbal mental age (VMA) are shown in Figure 1. The three-class solution was selected for NVMA (Age Appropriate, 78%, Delayed, 20%, and Significantly Delayed, 2%). Despite its small size, the Significantly Delayed trajectory was empirically supported and clinically meaningful. Unsurprisingly, NVMA class assignment was related to outcome (Figure 2; Fisher’s Exact Test, p<.001); there was no significant difference in assignment for toddlers with non-spectrum delay compared to ASD, though the sample size reduced power. The best-fitting model for VMA consisted of four classes: Age Appropriate (67%), Delay Catch-Up (9%), Delayed (17%), and Significantly Delayed (7%). VMA class assignment was also related to outcome (Figure 2; Fisher’s Exact Test, p<.001); toddlers with no delay outcomes comprised the Age Appropriate and Delay Catch-Up classes, while toddlers with non-spectrum delay and ASD predominantly formed the Delayed and Significantly Delayed classes, with no significant difference in assignment in toddlers with non-spectrum delay compared to ASD.
Conclusions: Results demonstrate significant heterogeneity in the cognitive development of toddlers with LD. Given that study recruitment was based on LD, the increased heterogeneity in trajectory observed for VMA compared to NVMA is unsurprising. Further, the four VMA classes were predictive of outcome classification, revealing variability in the development of toddlers with no delays, non-spectrum delay, and ASD outcomes, and demonstrating the link between impaired cognition and ASD in toddlers. We plan to extend these analyses to explore individual subscales of the MSEL.

74 **178.074** Trajectories of Focused Attention in Infancy Predict ASD and ADHD Symptoms at Age 3 Years.

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Background: The tendency to selectively sustain attention for longer durations correlates with better concurrent learning and better cognitive outcomes later in development. Whilst individuals with Autism Spectrum Disorder (ASD) are commonly observed to show high levels of focused attention once engaged, they may struggle with *selectively* applying this ability across a range of tasks and contexts. Indeed, ASD is highly comorbid with Attentional Deficit Hyperactivity Disorder (ADHD) and autism symptom severity has been found to associate with difficulties with selective maintenance of attention from the third year of life and beyond. Moreover, difficulties with selectively engaging and maintaining attention may underlie the difficulties with joint attention that are characteristic of ASD. It is not yet known however whether attentional difficulties are primary or secondary to the development of ASD and ADHD symptoms.
Objectives: To observe patterns of change in the tendency to selectively maintain attention across contexts in the first 3 years of life amongst infants at high risk for ASD. To relate these differences to ASD and ADHD symptoms at age 3 in order to better understand the etiology of ASD and ADHD comorbidity.
Methods: Tendencies in behaviour across contexts are most effectively and efficiently measured with parent report, particularly for infants where moment-by-moment fluctuations in state can be extreme. We therefore collected parent report of the tendency to exhibit focused attention using the Infant Behaviour Questionnaire–Revised at 10 and 14 months, the Early Childhood Behavior Questionnaire at 24 months and the Children’s Behavior Questionnaire at 36 months. This data was collected in a sample of 116 infants at high familial risk for ASD, and 27 low-risk controls. Parent report of autism and ADHD symptom severity at 36 months was captured using the Autism Diagnostic Interview and Child Behavior Checklist-Preschool Assessment respectively. Latent Growth Curve Models were used to examine inter- and intra-individual change over time. By the time of presentation this analysis will be extended to a further sample of 100 infants at high familial risk for ASD and 50 low-risk controls.
Results: Infant levels of focused attention are negatively associated with parent-reported symptoms of autism-related social difficulties (standardised β = -0.638, p<0.05) and ADHD symptoms (standardised β = -1.059, p<0.001) at age 3. Within the same model, growth in focused attention is also associated with parent-reported autism-related social difficulties (standardised β = -3.634, p<0.001) and ADHD symptoms (standardised β = -3.844 p<0.001), and parent-reported symptoms of ASD and ADHD are positively correlated (standardised β = 6.960 p<0.001).
Conclusions: High ASD and ADHD symptoms at age 3 are associated both with low infant levels of focused attention and with slow growth in focused attention. These data highlight the need for longitudinal models when investigating cognitive mechanisms implicated in developmental disorders and lend support to the theory that control of attention is implicated in the etiology of both ASD and ADHD. Further work is underway to validate these findings against observational measures of focused attention and ASD and ADHD symptoms.

75 **178.075** Treating Autism Symptoms in Infancy through Parent-Mediated Intervention

A. Tanner*, Education, Queen's University Belfast, Vancouver, BC, Canada*

Background: Recent research suggests autism symptoms can emerge as early as 6 months of age and are reliably detected as early as 12 months of age. Early Intensive Behavioral Intervention is the most established intervention for preschool aged children with autism, however best practices for intervention to treat autism symptoms in infancy are still being established.
Objectives: The present study uses behavior skills training to teach parents how to implement parent-mediated behavioral intervention strategies with their infants who are showing signs of Autism Spectrum Disorders (ASD).
Methods: Ten parent/infant dyads participated in the 12-week intervention, which consisted of1-hour weekly parent-coaching sessions, focusing on using daily routines such as mealtimes and play, to teach imitation, joint-attention and verbal behavior to their infants who ranged in age from 7-18 months. Five-minute videos were recorded at the start of every session and scored using partial interval recording for the presence of target behaviors. Three parent and three infant target behaviors were targeting throughout the twelve sessions
Results: Results will be discussed in terms of acquisition of target behaviors, reductions in autism symptoms using a low-intensity parent-mediated behavioral treatment model and the social validity of the intervention. All infant participants showed a significant decrease in autism symptoms after 12-weeks of parent-mediated intervention. Symptom reduction and acquisition of target behaviors maintained at 1 and 3 month follow-ups.
Conclusions: Behavior Skills Training was effective at teaching parent-mediated intervention to reduce autism symptoms in infants and young toddlers who were showing signs of autism.

76 **178.076** Utilising Technology for the Early Detection of Autism: Introducing Asdetect, an Early Detection Mobile Application for Caregivers

J. Barbaro *and N. Kolivas, Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia*

Background: Early detection of autism is vital as it provides access to early intervention, facilitating children's developmental outcomes and reducing family stress (Crane et al. 2016; Dawson et al., 2008; 2010; Howlin, 1997). Over the past 11 years, two community-based studies on the early detection of autism (Social Attention and Communication Study; SACS & SACS-Revised; Barbaro & Dissanayake, 2010; 2013) have been conducted within the Victorian Maternal and Child Health system, Australia. The SACS program is currently the most accurate and sensitive method for identifying autism in children under 24-months, but its use has been limited to universal services.
ASDetect (released February 2016) is a free mobile application that incorporates a modified version of the SACS training, and allows caregivers to monitor the signs of autism in children aged 11-30 months. Assessments at 12-, 18-, and 24-months contain 12-15 short videos demonstrating key social-communication behaviours, followed by 'mostly'/'rarely' questions. Behaviours found to be most predictive of autism by 24-months (Barbaro & Dissanayake, 2013) are used to determine a child's 'likelihood' for autism ('high vs 'low'), and caregivers are encouraged to share their child's results with their doctor.
Objectives: This study's objectives were to compare the responses for children at 'high' and 'low' likelihood for autism on each of the behavioural items, and qualitatively explore the experiences of, and actions taken by, caregivers following use of ASDetect.
Methods: 3452 assessments (with caregivers "opting in" for research) were undertaken at 12 (n=848), 18 (n=966), and 24-months (n=1638). Percentage of 'mostly/rarely' responses for each item was compared between children with a 'high' and 'low' likelihood of autism at each assessment using Fisher's exact probability test. A brief email survey was also sent out to all caregivers who opted into research.
Results: 932 children retuned a 'high-likelihood' result (73% male, 27% female), with 71% of caregivers reporting they already had prior concerns. All items at each age significantly differed between 'high' and 'low' likelihood groups; the strongest associations across each assessment involved *use of gestures, eye contact, pointing,* and *showing* (phi coefficient range = .63-.75), with 81-94% of 'high-likelihood' children rarely engaging in these behaviours, compared to 7-11% of 'low-likelihood' children. The survey (n= 122) indicated that 60% of parents whose children returned a 'high-likelihood' result arranged a follow-up appointment with their doctor, with 24% subsequently receiving a diagnosis (43% autism, 53% developmental/language delay, 14% "other"). Caregivers agreed/strongly agreed that ASDetect was "easy to use" (98%), the videos were helpful in illustrating the questions (97%), they knew more about social-communication milestones following its use (90%), and that they would recommend it to other parents (96%).
Conclusions: ASDetect has facilitated hundreds of families in seeking professional support following a 'high-likelihood' result for their child. Items that differentiated children at 'high' and 'low' likelihood for autism are strongly consistent with previous work identifying the predictors of autism in 12-24-month-old children. Projects are now underway to determine the psychometric properties of ASDetect in identifying children with autism, and translating the content into other major languages.

77 **178.077** Visual Attention Patterns in Toddlers with and without Autism

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Background: Eye-tracking studies have found that children with ASD show unique patterns of exploration, detail orientation, and perseveration in the Visual Exploration Task (VET), when compared to typically developing children. It is essential to use developmentally appropriate images and stimuli when designing the visual exploration task, as circumscribed interests may differ across different age groups. A toddler adaptation of VET (VET_T) was developed to capture the visual attention patterns of toddlers with ASD. However, VET_T needs to be validated as a reliable tool in capturing the differences in visual attention patterns between toddlers with and without ASD.
Objectives: This study compared the visual attention patterns of toddlers with and without ASD on the VET and VET_T, in an effort to: 1) examine differences in visual attention patterns of toddlers on the VET-T and on the original VET; and 2) compare differences in visual attention patterns between toddlers with and without ASD.
Methods: Thirty-nine toddlers with a diagnosis of ASD (17-35 months of age) and 21 without ASD (14-34 months of age) participated in this study. Each participant completed the VET and VET_T, which includes 12 VET arrays and 7 VET_T arrays. Randomized Arrays were organized to include high autism interest (HAI), low autism interest (LAI) and social items. Three major outcome variables representing visual exploration patterns were calculated: 1) Exploration: Number of images viewed per second onscreen, 2) Perseveration: Duration of fixation per image explored, and 3) Detail Orientation (DO): Number of discrete fixations per image explored. A series of repeated measures ANOVAs were conducted to test the differences in visual patterns of toddlers with and without ASD on the VET and VET_T.
Results: Toddlers with and without ASD showed different visual exploration patterns in the two tasks:
1) Both groups of toddlers were significantly more detail oriented in the VET_T (p<.05) and also showed significantly higher DO towards HAI items (p<.05) than toward social items and LAI items, especially in the VET_T (significant interaction effect, p<.001). There were no significant differences between toddlers with and without ASD;
2) No significant differences in exploration were found between tasks. However, both groups explored significantly more social items than LAI items. Also, the ASD group showed higher exploration during the tasks than the group without ASD (p<.05).
3) Toddlers showed significantly higher perseveration in VET_T (p<.05). No significant differences were found in stimulus types or between groups.
Conclusions: VET_T, which includes developmentally appropriate stimuli, is more effective at capturing the visual attention of when compared to the original VET. Thus, researchers should consider using this task when examining visual patterns in young children. Toddlers with ASD demonstrated different visual attention patterns across both tasks with higher exploration than toddlers without ASD. This finding indicated toddlers with ASD had visual exploration differences and this could be taken into consideration for intervention design. Further analysis will be done to explore the effects of autism symptoms and severity on toddler's visual attention patterns towards different items in the ASD group.

78 **178.078** Visual Local - Global Processing in 3 - Year Old at Risk Siblings with and without Diagnosis and Typically Developing Children

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Background:
Visual processing has been extensively investigated in individuals with autism spectrum disorder (ASD) aged 6 years and older. In brief, the literature suggests superiority in local processing, but also slower global processing than local processing in individuals with ASD. Little is known about local vs. global visual processing in young children with ASD.
Objectives:
The aim of this study was to investigate local and global processing in 3-year old high risk (HR) siblings with an ASD diagnosis (HR+), without ASD diagnosis (HR-), and in low risk (LR) siblings. We expected a local-over-global advantage in the HR+ compared to HR- and LR groups in terms of accuracy and/or response latency.
Methods:
Participants Thirty-two children (age M = 39.6 months, SD = 4.2) from the longitudinal Early Autism Sweden (EASE) study participated: eight LR (3 girls, 5 boys, age M 38.21 months, SD = 3.03), 16 HR- (11 girls, 5 boys, age M 39.64 months, SD = 4.33) and 8 HR+ (6 girls, 2 boys, age M 41.10 months, SD = 5.05).
Diagnostic assessment ASD diagnosis was based on clinical consensus and DSM-5 criteria, and supported by assessment with ADOS-2, ADI-R, Vineland II, and the Mullen Scales of Early Learning.
Local/Global tasks Established measures of local and global processing such as the Embedded Figures Test and the Fragmented Picture Test (modified to suit 3-year olds) were collected. In addition, the local measures Hidden Figures and Figure-Ground were applied as well as the global measure Closure. Accuracy, latency and local/global discrepancy of task performance were evaluated

Results:
A series of one-way ANOVAs with post hoc tests (Bonferroni corrected) were conducted for all visual processing measures. We found a significant between group effect for the local measure Hidden Figures [F (2, 29) = 5.28; p = .011], in which the HR+ group performed more accurately (M = 14.13; SD = 1.46) than both HR-and LR groups (M = 10.81; SD = 3.47, p = .013; M = 10.00; SD = 1.93, p = .016, respectively). No other group differences were found.
Conclusions:
In line with our hypothesis and with previous findings of a local processing bias in older individuals with ASD, three year olds with autism spectrum disorder showed superior performance on the local processing measure Hidden figures compared to both other groups. Although implications are limited due to small sample size and the fact that only one measure yielded significant results, the findings nevertheless extend earlier evidence of enhanced local processing in ASD to early childhood.

79 **178.079** Visual Search Cancellation and Autism Symptoms: What Young Children Search for and Co-Occurring ADHD Matter

B. R. Doherty[1], *T. Charman*[2], *M. H. Johnson*[3], *G. Scerif*[1] *and T. Gliga*[3], *(1)University of Oxford, Oxford, United Kingdom, (2)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom*

Background: Enhanced visual search is one of the most replicated findings in the autism spectrum disorder (ASD) literature and has been documented as young as in infancy and toddlerhood. Visual search in this context often refers to locating one target amongst distracters—less research has investigated search strategies when there are multiple targets amongst distracters, and no studies to our knowledge have manipulated targets and distracters to investigate varying search strategies based on task requirements. It is possible that in ASD performance will be poorer in a multiple target cancellation task, in particular when targets represent a conceptual category as opposed to an exemplar and thus require conceptual knowledge. Alternatively, poor search organization might be associated with attention deficit/hyperactivity disorder (ADHD) symptoms. In contrast, it is possible that performance will be enhanced when exemplar targets are perceptually similar to distracters, thus requiring perceptual abilities known to be enhanced in ASD.
Objectives: This study sought to investigate cancellation performance in 36-month-olds at high and low familial risk for autism, as well as associations with ASD and ADHD symptoms.
Methods: One-hundred and thirty-one 36-month-olds at high (n = 106) and low (n = 25) familial risk for ASD participated in the visual search cancellation task on a touchscreen monitor as a part of a battery of cognitive tasks. In this task, children were asked to search for and touch a) cats among inanimate objects (baseline, "exemplar search"), b) animals amongst inanimate objects (to test categorization, such that higher autistic symptoms were hypothesized to relate to worse performance, "conceptual search"), and c) dogs amongst furniture (to test for the ability to discriminate between perceptually similar objects, such that higher autistic symptoms were hypothesized to relate to better performance, "perceptual search"). The Autism Diagnostic Observation Scale (ADOS) was used to assess severity of autism symptoms and the Child Behavior Checklist (CBCL) was used to assess ADHD symptoms.
Results: While controlling for motor and language abilities, we found that ASD symptom severity did not associate with general enhanced performance in search, but did associate with poorer categorical search in particular, consistent with literature describing impairments in categorical knowledge in ASD. Furthermore, ASD and ADHD symptoms were both independently associated with more disorganized search paths across all conditions
Conclusions: ASD traits therefore do not always convey an advantage in visual search—this depends upon the nature of the stimuli (e.g., exemplar vs. categorical) and the presence of co-occurring ADHD symptoms.

80 **178.080** When High-Risk 2-Year-Olds without ASD Talk the Most

J. Migliaccio[1], *J. Parish-Morris*[2], *S. Plate*[3], *L. Bateman*[4], *J. L. Wood*[2], *R. F. Slomowitz*[5], *J. E. Maldarelli*[5], *J. Pandey*[5], *M. R. Swanson*[6], *S. Paterson*[7], *N. Marrus*[8], *A. Estes*[9], *H. C. Hazlett*[10], *L. Zwaigenbaum*[11], *K. Botteron*[12], *S. Dager*[13], *J. Piven*[14] *and R. T. Schultz*[5], *(1)James Madison University, Harrisonburg, VA, (2)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (3)Bryn Mawr College, Bryn Mawr, PA, (4)The Center for Autism Research/CHOP, Philadelphia, PA, (5)The Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (6)Carolina Institute for Developmental Disabilities, University of North Carolina at Chapel Hill, Carrboro, NC, (7)Children's Hospital of Philadelphia, Philadelphia, PA, (8)Department of Psychiatry, Washington University School of Medicine, St. Louis, MO, (9)University of Washington Autism Center, Seattle, WA, (10)Carolina Institute for Developmental Disabilities, University of North Carolina at Chapel Hill, Chapel Hill, NC, (11)University of Alberta, Edmonton, AB, CANADA, (12)Washington University School of Medicine, St Louis, MO, (13)University of Washington School of Medicine, Seattle, WA, (14)Carolina Institute for Developmental Disabilities, Carrboro, NC*

Background: Â Recent research using home-based digital audio recordings at 9 months of age suggests that some children at high-familial risk for ASD are "hyper-vocalizers," producing more vocalizations than low-risk peers (Swanson et al., in press). More vocalizations are associated with higher rates of conversational turn-taking, potentially contributing to a "social feedback loop" that is beneficial to children's social development (Warlaumont, 2014). It is not yet known whether increased vocalization rates remain characteristic of high-risk children as they age, or whether these patterns differ in children ultimately diagnosed with ASD. In this study, we test "hyper-vocalization" in a new setting (clinical assessment) with older children (2-year-olds) and gold standard human coding to identify speech and non-speech vocalization.
Objectives: Determine whether vocalization patterns distinguish 2-year-olds: (1) at high-familial risk for ASD by virtue of having an older sibling with ASD, but not currently diagnosed with ASD themselves (HR-), (2) at low-familial risk for ASD with no ASD diagnosis themselves (TDC), and (3) children who have an older sibling with ASD and are also diagnosed with ASD (ASD).
Methods: Â Thirty-three 2-year-olds (9 ASD, 12 TDC, 12 HR-) were administered the Communication and Symbolic Behavior Scales (CSBS; Shumway & Wetherby, 2009) as part of a longitudinal study (IBIS; Estes et al., 2015). Vocalizations were coded as "speech" or "non-speech" by two blind reliable transcribers ("vegetative" vocalizations were excluded from the current analyses). T-tests compared the percentage of total recording duration occupied by child vocalizations of any type, percentage of speech and non-speech vocalizations relative to total recording length, and number of speech and non-speech vocalizations produced per 10 minutes.
Results: HR- children vocalized for a significantly greater percentage of time (21.5%) than ASD children (13.5%; $p<.05$), with TDCs falling between (16.7%). All groups produced a significantly higher percentage of speech vocalizations than non-speech vocalizations (all ps<.05). The HR- group produced the highest percentage of speech sounds, with a significantly higher percentage (17%) than the ASD group (11.6%; $p=.05$), but not statistically more than the TDC group (14.5%), which was also not different from the ASD group. HR- children produced a greater *number* of speech vocalizations per 10 minutes (Mean=6.56, SD=2.38) than ASD children (Mean=4.07, SD=1.92), suggesting more frequent speech vocalizations. The TDC group mean (5.81, SD=2.71) did not differ from either risk group. Non-speech vocalization rates did not differ by group.
Conclusions: Our data, using gold standard human coders and standardized assessment, are consistent with recent research using home-based recordings to capture vocalizations in 9-month-old infants at high- and low-risk for ASD. Our convergent data suggest that some children at high risk for ASD may possess characteristics that lead to increased vocalization. These same characteristics may simultaneously confer protection against developing ASD, in part by contributing to an active "social feedback loop" that supports social development by providing enriched opportunities for conversational turn-taking (Warlaumont et al., 2014). We anticipate coding 6- and 12-month-old assessments for each child prior to May 2017, to model developmental trajectories in speech and non-speech vocalization across risk groups.

81 **178.081** Variation in Social Visual Engagement - a Putative Autism Endophenotype - Reflects Stringent Genetic Control in Early Childhood

S. Kennon-McGill[1], *N. Marrus*[1,2], *C. Weichselbaum*[3], *A. Klin*[4,5,6], *W. Jones*[4,5,6] *and J. N. Constantino*[1,2,7], *(1)Department of Psychiatry, Washington University School of Medicine, St. Louis, MO, (2)Intellectual and Developmental Disabilities Research Center, Washington University, St. Louis, MO, (3)Psychiatry and Genetics, Washington University School of Medicine, St. Louis, MO, (4)Marcus Autism Center, Children's Healthcare of Atlanta & Emory University School of Medicine, Atlanta, GA, (5)Center for Translational Social Neuroscience, Emory University, Atlanta, GA, (6)Department of Pediatrics, Emory University School of Medicine, Atlanta, GA, (7)Department of Pediatrics, Washington University School of Medicine, St. Louis, MO*

Background: Â Diminished eye contact—and more specifically, atypical development of social visual engagement (SVE)—has been shown to predict autism spectrum disorder (ASD) by as early as 6 months-of-age among infants at elevated familial risk for ASD. Deviations in visual orientation to socially-salient cues in the course of moment-to-moment life experience are a target of early intervention for ASD, but the nature of causal influence on variation in SVE in early childhood , as well as the genetic structure, is unknown.
Objectives: Â This study aims to examine the genetic structure of early SVE in an epidemiologically-ascertained sample of normal, like-sex toddler twins.
Methods: Â We examined patterns of concordance in how children visually engage a caregiver's face and how they observe and seek information in the actions and reactions of peers. By collecting eye-tracking data from 338 toddlers, we first examined pairwise concordance in social visual engagement as a function of genetic and environmental variation in 82 monozygotic twins (MZ, 41 pairs), 84 dizygotic twins (DZ, 42 pairs), and 84 non-biologically-related toddlers (42 randomized pairs, matched by age and sex). Our experiments measured both macro-level indices of SVE (e.g. percentage of time spent looking at eye regions), as well as micro-level indices (e.g. timing of individual eye movements, direction of eye movements, etc.).
Results: Â For concordance in eye- and mouth-looking, MZ twin-twin intraclass correlations (ICCs) were remarkably high: 0.91 for eyes (95% CI: 0.85-0.95) and 0.86 for mouth (95% CI: 0.76-0.92). This markedly contrasted with correlations for DZ twins: eyes, 0.35 (95% CI: 0.07-0.59) and mouth, 0.44 (95% CI: 0.16-0.65). We also found similar striking concordance among MZ twins compared to DZ twins for micro-level, moment-by-moment SVE. MZ twins demonstrated greater probability of moving their eyes at the same times: for each movement made by twin 1, within 350 milliseconds, there was an 18.6% increase in twin 2's probability of *also* making an eye movement. When analyses were restricted to moments of motor *initiation*of the saccade, we observed a 21.1% increase in probability of time-locked eye movements: within +/-16.7 msec, MZ twins, but not DZ twins, initiated saccades at the same moments.
Conclusions: MZ twins exhibit strikingly high concordance in overall levels of eye-looking; greater probability of shifting their eyes at the same moments in time; greater probability of shifting their eyes in the same subsequent directions; and greater probability of contemporaneously fixating on the same semantic content. These high levels of MZ concordance, observed at both macro- and micro-levels, indicate strong biological basis for variation in social visual engagement, with a substantial amount of that variation accounted for by genetic influence.

Poster Session
179 - Family Issues and Stakeholder Experiences II
12:00 PM - 1:40 PM - Golden Gate Ballroom

82 **179.082** "Luchando Por Ellos:" Understanding Beliefs about ASD from First Generation, Mexican Parents

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Background:
Beliefs about ASD relate to parents' treatment decisions (Blacher, et al., 2014). Parents' beliefs about ASD shape parents' reports of symptoms, the time they take to seek treatment, and the treatment they select (Ravindran et al., 2014). Some Latino parents make religious attributions about their child's disability that may shape treatment decisions. For example, some Latino parents believed that their child with disabilities was a punishment from God, others believed that the child was a gift from God, still others believed that God sent this child to test them (Bailey, et. al., 1999). Beliefs may cause parents to delay seeking treatment or to seek alternative treatment. In a study examining Latino families and their children with ASD, parents were found to endorse non evidence-based treatments that did not meet efficacy standards (Levy et al., 2003).
Objectives:
Understanding parents' beliefs about ASD may shape treatment of ASD for Mexican-heritage (MH) children, whom are diagnosed at 50 percent below the national average and have low treatment participation rates (CDC, 2014, Lopez, et. al., 2013). The objective of this study was to understand MH parents' beliefs about ASD and its causes.
Methods:
Participants were 28 MH parents (22 first generation; *M* age= 37; *SD* = 5.8) of children with ASD (*R* = 2 to 15 yrs old). Researchers employed cultural consensus modeling (Weller, 2007) in audiotaped focus groups to assess parents' beliefs about two questions: "Please tell me what words or phrases you think of when you think about children with autism;" and "What do you think causes autism?" Participants ranked their responses in order of importance. Researchers compiled free lists and determined the total number of distinct responses for each question. Saliency scores for ranked items were calculated and an average score was determined for each response among those included in the participant's rankings. Participants rationalized each step of the process.
Results:
Preliminary results indicated 62 distinct responses for Question One and 31 distinct responses for Question Two. When tabulating the free-list items across the focus groups, responses that described similar concepts were grouped together. For example, "falta de aceptacíon de otros niños o personas" (*lack of acceptance from other children or people*) was grouped with a similar response in a different focus group: "*discriminacíon*" (discrimination). The three most salient responses for Question One were "Que necesitan mucha ayuda." (*That they need a lot of help*);Â "muy cariñosos" (*very affectionate*); and "se necesita más informacíon." (*One needs more information*). The three most salient responses for Question Two were "La alimentacíon," *(what you eat)* "La genetica," (*genetics)* and "Vacunas" *(vaccinations)*.
Conclusions:
Parents' responses to Question One identified stigma – a negative evaluation of the child and family - as a theme. Saliency scores for Question One showed parents' beliefs as child-centered, even identifying the child's strengths (i.e., affectionate). Saliency scores for Question Two identified several beliefs, one of which is not supported by empirical evidence (i.e., vaccines) (DeStefano, et. al., 2013). Future analyses will utilize the transcribed interviews to rationalize parents' beliefs.

83 **179.083** A Peer-Support Group for Typically Developing Siblings of Individuals with ASD in India

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Background: Having a person with autism in the family, can be challenging for all members, including the typically developing siblings of the person with autism. In most communities, parents of children with similar conditions have the opportunities to interact while availing services for their child or by participating in parent support groups. However, it is very common for typically developing siblings to not get an opportunity to share their experiences with other siblings. They go through life feeling 'alone', often resenting their sibling with disability, and not fully understanding the implications of having a brother or a sister with autism. This is especially of great concern in low and middle income countries like India, where no state support is as yet available, and the unspoken cultural expectation is that the typical sibling will care for the autistic sibling once the parents are no more. To understand the experiences of typically developing siblings of individuals with autism, we conducted Awesome Sibling Meetups (ASM) a peer support programme based on US based sibling support model *Sibshops.*
Objectives: The study evaluates the impact of a peer support programme on a typical sibling's knowledge of autism; behaviours towards the autistic sibling; their individual strengths and difficulties; quality of friendships and coping styles. It also evaluates the impact of the programme on the relationship between the two siblings.
Methods: Nine typically developing siblings participated in a peer-support programme at Action for Autism, the National Centre for Autism in India. Twelve sessions of 3-4 hours each were conducted over a period of four months. The sibling support model *SibshopsÂ* was adapted for the Indian culture and was a mix of fun activities with primary focus on peer support. The programme was a safe place for siblings to share their feelings with other sibling participants. The typically developing siblings were assessed at the beginning and at the end of the programme. Additionally, parents were interviewed about relationship between the two siblings; typical sibling's strengths, difficulties and behaviours towards the autistic sibling; their parenting and coping styles.
Results: Findings from sibling measures indicate an increase in the knowledge of autism; decrease in anger/resentful feelings towards autistic siblings; and use of more positive coping styles. Parents reported decrease in negative behaviours towards the autistic siblings by the typically developing siblings. Results also indicate a decrease in typical siblings emotional, conduct, and peer problems; and an increase in their prosocial activities.
Conclusions: This is one of the few studies in a low resource country like India, which focusses on typically developing siblings of children with autism. Results support the need for such group interventions and controlled evaluation of sibling support groups to improve mental health and functioning of typically developing sibling. It has implications for running sibling support groups in low resource countries.

84 **179.084** AIRB3: Measuring Collaborative Networks Among Parents and Autism Intervention Providers during the Pre-Transition Period.

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Background: Finding and arranging interventions for children with ASD and coordinating them across the life course presents many challenges for people with autism, their parents and providers. Collaboration is particularly challenging during transitions, such as when moving from preschool to kindergarten or middle school to high school.
Objectives: To use social networks techniques to measure collaboration for children with ASD.
Methods: Participants were 6 children with ASD from families with incomes below the poverty line who were transitioning to a new school: 3 children transitioning from middle to high school, 2 from elementary to middle and 1 from pre-school to kindergarten. We used a three stage snowball process to identify individuals involved during the pre-transition period. This process yielded 59 key people, from which we recruited 42. The Social Dynamics of Intervention (SoDI) survey tool was conducted at the end of the school year before the transition to the new school.
Results: Â Child team size varied from 15 to 30, with a mean of 12 people identified as “key” and 10 identified as “not key”. Most school and district staff identified were from the pre-transition school (mean = 76%). Fewer were identified as district staff (mean = 17%). Only 2 teams identified people from the post-transition school.Â Participants often named people as team members that parents did not identify.Â On average, 52% of relied on providers that were not named by the parent. About half of identified team members were considered “inner circle” providers (mean = 47%) and 1/3 (mean = 38%) were “outer circle” providers. The majority of team members were school and district providers (mean = 61%). Fewer healthcare providers (mean = 10%), community members (mean = 10%) and family members (mean = 14%) were identified. Parents were identified as essential inner/outer participants team members by a small number of people per team (mean = 3.5 participants). Meanwhile, parents identified more team members as essential (mean = 9.3 participants). See Table 1 for summary of results. **Social network analysis indicated thatÂ** an average of 3.50 team members (per team) reported that they relied on the primary parent for essential support with the child’s interventions and primary parents reported that they relied on an average of 4.80 team members (per team) for essential support with the child’s interventions. Parents varied in the degree of leadership they had within each team (eigenvector centrality). Only one parent had a high eigenvector score (.85 SD above random mean).Â See Figure 1 for sociograms.
Conclusions: On average, parents did not identify 52% of the people identified as essential. This suggests that parents did not rely on many of their child’s everyday providers. With the exception of one team, none or few people from the post transition context were involved with the child’s team during the pre-transition period. Network findings suggest that parents relied on other team members more than other team members relied on them for support of the child’s everyday interventions. Only one parent emerged as a leader among team members.

85 **179.085** ASD Symptom Severity Moderates the Relationship Between Child Externalizing Behavior and Maternal Stress

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Background: Children with autism spectrum disorders (ASD) present a greater number of externalizing behaviors than typically-developing (TD) children (Mahan & Matson 2011). These behaviors present unique stressors to mothers of children with ASD (Peters-Scheffer et al. 2012). Mothers have also reported experiencing elevated levels of stress when raising children with severe ASD symptoms compared to mothers of children with low ASD symptomatology (Konstantareas & Papageorgiou 2006). Similar studies suggest that externalizing behaviors in youth with ASD are stronger predictors of maternal stress than ASD symptoms (Peters-Scheffer et al. 2012, Lecavelier & Wiltz 2006). Previous research also suggests that externalizing behavior is more likely to predict maternal stress even when holding the severity of ASD symptoms constant, and that it remains a stronger predictor even when measured alongside other stressful ASD related symptoms (Peters-Scheffer et al. 2012). It is not known, however, whether degree of ASD symptomatology and child externalizing behaviors interact in relation to maternal stress. Objectives: The present study analyzes whether ASD symptomatology moderates the relationship between child externalizing behaviors and maternal stress. Methods: Mothers (N = 223) with exactly one child with ASD (ageÂ *M*Â = 6.74,Â *SD*= 2.99; 84% male) completed the Behavioral Assessment System for Children (BASC-2; Reynolds & Kamphaus, 2004) as a measure of externalizing behaviors and the Social Responsiveness Scale-2 (SRS-2; Constantino et al., 2012) to identify the presence and extent of autistic social impairment in the child. Mothers self-reported stress indices via the Parental Stress Index (PSI-4-SF; Abidin 2012). Results: Total child externalizing behaviors were found to predict maternal stress, particularly in the Difficult Child Subscale of the PSI (*β=Â* -.57,Â *p*<.001). Moderation analyses revealed that SRS-2 total scores moderated the relationship between child externalizing behaviors and maternal stress (*B=Â* -.01,Â *p*<.001), such that the relation was strongest when child ASD symptoms were low (*B*= .66,Â *p*<.001; Figure 1). Post-hoc probing indicated that the same pattern of effects was found in all subdomains of externalizing behaviors (hyperactivity, aggression, and conduct problems allÂ *B*=-.01, p<.02) and with all SRS-2 subscales (allÂ *B*Â < -.01,Â *p*< .007). Conclusions: Externalizing behavior in ASD youth was found to predict maternal stress, with a stronger effect seen in children with lower ASD symptomatology. Essentially, the relationship between externalizing behavior and maternal stress was strongest at low levels of ASD symptomatology. It may be that mothers of children with fewer ASD symptoms may attribute parenting stress to child externalizing behaviors, whereas mothers of those with high ASD symptoms may attribute stress to ASD symptoms. Specifically, mothers’ behavioral expectations may differ when perceiving their child’s social ability as greater than other children with ASD (Mori et. al 2009).Â Subsequently, these expectations may affect mothers’ sense of parenting efficacy, leading to increased stress. The poignant relationship found between externalizing behavior, maternal stress and ASD symptomatology demonstrates a significant need in providing relevant and comprehensive interventions that address all three elements of this model, thereby ameliorating stress levels in mothers and improving family quality of life for families of youth with ASD.

86 **179.086** Acceptance or Forever Seeking Answers ? Adaptive and Maladaptive Responses to Having a Child with ASD

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Background:
Parenting a child diagnosed with an autism spectrum disorder (ASD) is often associated with chronic stress, elevated anxiety, and depressive symptomology. While this might be true for some, there are caregivers who show psychological resilience as indicated by low levels of reported stress and decreased symptomology. This healthy adaptation might be explained by the caregiver's ability to accept the child's ASD diagnosis. Previous studies have shown that caregivers who had resolved their negative emotions toward their child's diagnosis reported lower stress, while parents who had not experienced emotional resolve reported stress in clinically significant levels. To date, only one instrument, the Reaction to Diagnosis Interview (RDI) (Marvin & Pianta, 1996), has been extensively used to capture caregiver reaction to their child's diagnosis of a chronic illness or disability, categorizing parents as either resolved or unresolved. No measures have examined reactions to having a child with an ASD. Here we examine a new measure of adaptation.
Objectives:
We examined a novel 30-item questionnaire, Adjustment to the Diagnosis of Autism (ADA) developed by Bryna Siegel. This scale was designed to assess the range of parent emotional and attitudinal reactions to their child's diagnosis of autism.
Methods:
We administered the scale to a sample of 77 mothers of children with ASD. We conducted a factor analysis to identify constructs illustrative of acceptance or non-acceptance of the ASD diagnosis. Principal components analysis was performed using direct oblimin rotations with Kaiser normalization to allow for correlations between the extracted components.
Results:
The Bartlett's test of sphericity was significant ($\chi 2$ (435) = 1417.63, $p < .01$). The three factor solution, which explained a cumulative 32.47% of the variance, identified three subscales with primary loadings that ranged from .3 to.75. Factor 1: Externalizing Blame (unresolved/non-acceptance), included "A parent never really gets over a diagnosis of autism in their child." Factor 2: Self-Blame (unresolved/worry), included "There are things I did that make me worry that I contributed to my child's difficulties." Factor 3: Acceptance (resolved/acceptance), included "I have a greater acceptance of my child's autism than I used to." Only one item "I wish we lived in a time or place where parents were expected to leave children like this in a home or hospital" was eliminated because it failed to meet a minimum factor loading criteria of 0.3 or above and did not contribute meaningful information to the three proposed constructs.
Conclusions:
The autism research community knows anecdotally the wide range of coping responses to the diagnosis, but these have not been easily measureable. This novel instrument offers a way to measure caregivers' acceptance or non-acceptance of the autism diagnosis. This could have implications for parental mental health, selection of therapeutic options, and ability to participate in behavioral therapy. Future studies can utilize the instrument to determine the predictive ability of acceptance with family and child behavioral and mental health outcomes.

87 **179.087** Acceptance or Forever Seeking Answers? Adaptive and Maladaptive Reactions to Your Child with ASD

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Background: Parenting a child diagnosed with an autism spectrum disorder (ASD) is often associated with chronic stress, elevated anxiety, and depressive symptomology. While this might be true for some, there are caregivers who show a certain degree of resilience as indicated by low levels of reported stress and decreased psychological symptomology. This adaptation might be explained by the caregiver's resolve to accept the child's ASD diagnosis or not. Previous studies have shown that caregivers who had resolved their negative emotions toward their child's diagnosis reported lower stress, while parents who had not experienced emotional resolve reported stress in clinically significant levels. To date, only one instrument, the Reaction to Diagnosis Interview (RDI) ((Marvin & Pianta, 1996), has been extensively used to capture caregiver reaction to their child's diagnosis of a chronic illness or disability. The instrument categorizes parent responses to six open-ended questions into two constructs, resolved or unresolved. Being resolved represents acceptance of the child's diagnosis and is equated with adaptive coping, a mechanism that contributes to better health and psychological well-being. A majority of studies have utilized the RDI for child diagnoses such as cerebral palsy, epilepsy, and phenylketonuria (PKU). However, only two have used the RDI to assess parent reaction to their child's diagnosis of autism. In both instances, the open-ended interview captured data cross-sectionally and not over time.
Objectives: We evaluated a novel 30-item questionnaire, Living with Autism (LWA) (Siegel, 2010), designed to specifically address parent reactions to their child's diagnosis of autism with a sample of 77 maternal caregivers of children with ASD.
Methods: We conducted a factor analysis to identify constructs illustrative of acceptance or non-acceptance of the ASD diagnosis. Principal components analysis identified a solution for three factors, each examined using direct oblimin rotations with Kaiser normalization to allow for correlations between the extracted components.
Results: The Bartlett's test of sphericity was significant ($\chi 2$ (435) = 1417.63, $p < .01$). The three factor solution, which explained a cumulative 32.47% of the variance, identified three subscales with primary loadings that ranged from .3 to a high of .75. Factor 1: Externalizing Blame (unresolved/non-acceptance), included "*A parent never really gets over a diagnosis of autism in their child.*" Factor 2: Self-Blame (unresolved/worry), included "*There are things I did that make me worry that I contributed to my child's difficulties*." Factor 3: Acceptance (resolved/acceptance), included "*I have a greater acceptance of my child's autism than I used to.*" Only one item "*I wish we lived in a time or place where parents were expected to leave children like this in a home or hospital*" was eliminated because it failed to meet a minimum factor loading criteria of 0.3 or above and did not contribute meaningful information to the three proposed constructs.
Conclusions: This novel instrument offers promising insight to caregivers' acceptance or non-acceptance of the autism diagnosis. Future directions could utilize the instrument to determine the predictive ability of acceptance with psychological outcomes, such as perceived stress and/or depressive symptomology.

88 **179.088** Access to Autism Information and Services for Korean American Families of Children with ASD

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Background:
Koreans are the fifth largest Asian group in the U.S., but are still underrepresented in autism studies examining service disparities. Often, Koreans are not included in these studies (Liptak et al., 2008) or collapsed into "others" or "Asian Americans" (Thomas et al., 2007; Mandell et al., 2009). These umbrella terms mask cultural differences within Asian Americans and their unique needs in accessing autism services.
The Korean culture is highly collectivistic and tends to stigmatize mental health issues, discouraging families from accessing appropriate services (Papadopoulos, Foster, & Caldwell, 2013). A large-scale study found Korea's ASD prevalence to be a staggering 1 in 38 children, but many were untreated or misdiagnosed due to stigma (Kim et al., 2011).
Limited English proficiency is associated with underutilization of services and reliance on online help (Spencer & Chen, 2004). Grinker et al. (2015) found that Korean mothers consulted Korean websites as their primary ASD information source due to language barrier.
Experiences of Korean families of children with ASD need to be examined in order to address service barriers and underrepresentation of Koreans in autism research.
Objectives:
The goal of this study was to explore barriers in accessing autism services and potential solutions for Korean American families.
Methods:
Semi-structured focus groups were conducted with 13 Korean mothers of children with ASD recruited in Los Angeles and Sacramento, CA. Participants were first generation immigrants, whose length of time lived in the U.S. ranged from 10 months to 27 years. Focus group sessions were scribed, audio-recorded, and transcribed. Dedoose software was used for qualitative coding of the transcripts. Coders were trained until interrater reliability was established. Discrepancies in the codes between the coder and a second reviewer were reconciled through consensus.
Results:
Language barrier and lack of social support were common themes. Even the most acculturated parents preferred bilingual therapists but had minimal success in finding them. Pediatricians' and parents' lack of autism knowledge, and elders in the family and professionals reassuring parents to "wait and see" were barriers to receiving a diagnosis. Other challenges included long waiting lists for services and being unfamiliar with the system. Some parents mistrusted Korean pediatricians, but still resorted to going to them due to language barrier.
Parents found other parents of children with ASD and Korean websites helpful. However, these websites were discussion forums where information is not monitored for accuracy. Parents agreed that autism education for pediatrician and parents is needed. Many wanted a website containing information about local bilingual providers, services organized by child's age, and other autism resources in Korean.
Conclusions:
As all participants were first generation immigrants, their biggest challenges were language barrier and lack of social support. In particular, language affected multiple domains directly related to service access, such as obtaining knowledge, selecting providers, and advocating for themselves. As a potential solution to mitigate these issues, parents recommended development of a Korean website with detailed information about services.

89 **179.089** An Exploratory Study of the Impact of Autism Traits on Parenting

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Background: Despite a rich general literature on parenting typically developing children (TD), there is a paucity of research examining the influence of autism traits on parenting. Given that autism traits are believed to be normally distributed and are associated with traits such as anxiety and depression, they may have a negative impact on parenting. However, no studies to date have examined whether such traits are related to parenting TD children. Such information is important to establish the need, if any, for parenting supports for parents with high autism traits.
Objectives: Our overall aim was to investigate the influence of autism traits on self-reported parent's sense of competence to establish whether they influence the parenting of TD children. We also investigated whether autism traits contribute to the self-reported parent-child relationship, and whether parenting needs differ between parents with high and low traits of autism.
Methods: Fifty-eight (58) parents (50 mothers) with either a child/ren or a first degree relative with autism *and*a TD child under 18 years (target child) completed the Autism Quotient (AQ). In addition to a set of control measures (e.g., SES, Depression, Anxiety and Stress etc.), parents completed questionnaires on Parenting Sense of Competence, the Parent-Child Relationship, Parenting Difficulties and Family Quality of Life (QoL). They also completed the Child-AQ and the Strengths and Difficulties Questionnaire (SDQ) with regard to their target TD child.
Results: Parent AQ scores were moderately correlated with the Child-AQ (r= .34), but not with the SDQ. Regression analyses examined the unique contribution of parental autism traits to parenting and quality of life (QoL) variables, and the parent-child relationship (after controlling for the DASS). Autism traits did not uniquely contribute to parenting satisfaction and efficacy (competence), QoL, or the parent-child relationship, with the exception that parents with high autism traits reported less involvement with their TD child.
Parents with high (>26; n = 20) and low (<20; n = 32) AQ scores were compared on reported parenting difficulties/needs; parent with high autism traits reported significantly more parenting difficulties/needs compared to parents with low traits.
Conclusions: The wealth of available parenting resources may not address the specific needs of parents on the autism spectrum. Although autism traits did not impact on parenting sense of competence, QoL or the parent-child relationship, they impacted on parent-reported levels of involvement with their TD child, and parenting difficulties. Thus, supports should be built around these specific aspects of parenting to assist parents on the autism spectrum prosper in their parenting role.

90 **179.090** Anxiety and Depression in Chinese Parents of Children with Autism Spectrum Disorder (ASD)

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Background:
Anxiety and depression are very prevalent in parents of children with autism spectrum disorder (ASD). However, reasons behind such high prevalence of affective problems iare currently unknown. Research to date has mainly considered the impact that children with autism have on parental levels of affective disorders, suggesting that behavioural and emotional problems in children can have more significant impact than the core ASD symptoms. However, it is clear that some of the parental own traits can on one hand buffer against the negative effects of stress and thus serve as resilience factors, and on the other hand increase risk for negative outcomes. Two of parental traits that have been previously identified as risk factors for anxiety in both general population, and in population of mothers of children with ASD are Intolerance of Uncertainty (IoU) and Hypersensitivity. However, the relative contribution of children's and parental own traits to parental well-being haven't been explored before.
Objectives:
(1) explore levels of anxiety and depression in a population of Chinese parents of children with ASD; (2) explore the impact of children's behavioural problems, parental traits of IoU and Hypersensitivity on parental anxiety and depression.
Methods:
One hunder twenty seven parents (108 mothers) of children with ASD (106 males) completed Depression Anxiety and Stress Scale-21 (DASS-21), Intolerance of Uncertainty-12 scale (IoU-12), Highly Sensitive Person Scale (HSP) and Strengths and Difficulties Questionnaire (SDQ) as measures of parental anxiety and depression, IoU, Hypersensitivity and children's behavioural problems respectively. Mean age of parents was 35.73 years (SD= 4.11) and mean age of children was 5 years (SD= 2.78).
Results:
Fifty nine percent of parents met the DASS-21 cut-off criteria for elevated anxiety (mild: 19.7%, moderate: 11%, severe: 10.2%, extremely severe: 17.3%) and fifty one percent for elevated depression (mild: 14.2%, moderate: 21.3%, severe: 12.6%, extremely severe: 2.4%). Parental anxiety and depression were associated with their children's emotional problems (r= .324, p <.001; r= .267, p =.002 respectively), and their own levels of IoU (r= .624, p <.001; r= .656, p <.001) and Hypersensitivity (r= .412, p <.001; r= .362, p <.001). In addition, parental anxiety was associated with their children's hyperactivity problems (r= .187, p= .035). When entered into the regression models, these variables accounted for 44.6% of variance for anxiety (F= 24.557, p <.001; IoU and emotional problems being unique, independent predictors, t = 6.53, p < .001, β = .237; t = 3.15, p = .002, β = .497 respectively) and 46% of variance for depression (F= 34.908, p <.001; IoU and emotional problems being unique, independent predictors, t = 7.98, p < .001, β = .281; t = 2.512, p = .013, β = .378 respectively).
Conclusions:
This is the first study to explore the contribution of children's behavioural problems, and parental levels of IoU and Hypersensitivity in predicting parental anxiety and depression. Implications for designing efficacious parental support programs will be discussed.

91 **179.091** Assessing Predictors of Perceived Utility of Biological Testing Among Parents of a Child with Autism

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Background: The development of biological testing for autism from identifying autism biomarkers has the potential to facilitate identification and allow for tailored and targeted treatments. In ensuring that future biological testing would address the needs of affected families, it is crucial to anticipate potential benefits and challenges posed by biological testing by assessing family's perceived utility of biological testing. Previous research, predominantly qualitative, has suggested some parents found biological testing beneficial to improve care while others questioned its value. However, there is no consistent definition of perceived utility and no previous studies have examined its potential predictors.
Objectives: We defined perceived utility of biological testing as the potential benefits and risks for families considered by families to be possible as a result of biological testing. Our aim is to examine the extent to which a new measure of perceived utility of biological testing among parents of a child with autism is associated with level of knowledge of autism, time since diagnosis, and symptom severity.
Methods: Data were drawn from an ongoing prospective study, *ASD Genome to Outcome*. Children were enrolled when being referred for an autism evaluation or have a confirmed diagnosis of autism for which genetic testing is recommended or has already been performed. A systematic process was used to develop two questionnaires to assess perceived utility and knowledge with input from the target population to establish content validity. The perceived utility questionnaire consists of 23 items with a 4-point Likert scale. The knowledge questionnaire consists of 19 items with a true or false response option. Potential confounds, namely age of respondent, household income, and education, were assessed and would be controlled for statistically if they are associated with perceived utility.
Respondents (n=20) had a mean age of 40.7 years old (*SD*=9.15) and were mostly mothers (90%). Their child with autism (n=15 males) had a mean age of 6.7 years old (*SD*=3.60).
Results: Age of respondent, household income, and education were not associated with perceived utility. Clinician-rated symptom severity was associated with perceived utility of biological testing. Parents of a child with high social communication severity reported significantly higher perceived utility (*M*=89.9, *SD*=5.02) compared to those of a child with moderate social communication severity (*M*=80.4, *SD*=4.56), $t(7)$= 2.84, p=0.025. Contrary to our prediction, knowledge of autism and time since diagnosis were not significantly correlated with perceived utility of biological testing ($r(18)$ = -0.20, p = .40, $r(11)$ = -0.26, p = .40 respectively). However, the two predictors were correlated: longer time since diagnosis was associated with higher levels of knowledge of autism, $r(11)$ = 0.57, p= .03.
Conclusions: Ongoing administration of the questionnaire in the target sample size of n=150 would clarify possible determinants for family engagement in biomarker discovery. The study allows for future work to address specific determinants to improve family engagement in biomarker discovery.

92 **179.092** Assessment of Community Participation and Self-Determination As Outcomes of Transition for Youth and Young Adults with ASD

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Background:
The Individuals with Disabilities Education Act (2004) mandates transition planning for all students with Individual Education Programs. But research suggests that the transition planning process need improvement (Cameto, Levine, & Wagner, 2004). National data of transition outcomes indicate adults with ASD have the lowest rate of employment, and the highest rate of no activities (Shattuck et al., 2012). As part of a larger study that used focus group methodology to identify issues of transition planning, two transition outcomes emerged as important to key stakeholders. Participants suggested that student self-determination and participation in the community are important in relation to transition and could indicate the quality of transition planning outcomes. Thus, two constructs – self-determination and community involvement – are critical skills that, if targeted during transition planning, have promise for improving post-school outcomes. Self-determination refers to self-advocacy that can be operationalized as setting goals reflecting personal interests and making choices (Wehmeyer & Field, 2007). Community involvement considers participation in structured activities (e.g., work), unstructured activities (e.g. leisure), and memberships. However, rarely are these aspects of transition planning considered (Carter et al., 2013).
Objectives:
To describe (a) student's self-determination associated with transition planning and (ii) community involvement.
Methods:
A review of literature using the words "measurement of self-determination, measurement of community integration, transition, adolescence, and autism" was conducted to find instruments that captured these aspects of transition. Because no measures captured the constructs based on our needs, a measure of self-determination was developed that was comprised of 12 items (4-pt scale, 1 = strongly disagree to 4 = strongly agree) and covers three broad areas of transition meeting participation, goal setting and attainment skills and choice-making The transition participation consisted of 4 items (α = .84), goal settings and attainment skills consisted of 4 items (α = .88), and the choice making consisted of 4 items (α =.94). For community involvement, a survey of 33 items was developed that covered seven types of activities (leisure, daily life, social media, etc) and was assessed based on frequency of participation (rarely/never to several times each day). Data from 7 parents of children with ASD completed the survey. Frequency tables were generated for self-determination and community participation. Data are currently being collected on 18 additional youth as part of a randomized controlled trial (RCT).
Results:
Preliminary results indicate low self-determination skills for transition age youth with ASD for participating in the transition planning process (M = 2.33, SD = .72), for goal setting and attainment skills (M = 2.29, SD = .96), and for choice making (M = 2.37, SD = .95). For community participation, parents reported highest participation for watching TV (about daily) and lowest for participating in activities such as team sports. Only one parent reported involvement in extracurricular activities.
Conclusions:
Results from parent reports indicate moderately low levels of self-determination among their adolescents with ASD and low levels of community participation. We will have more data as part of a RCT by May.

93 **179.093** Associations Between Understanding of ASD and Perceptions of the Sibling Relationship

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Background:
Autism Spectrum Disorder (ASD) is a condition that impacts not only the affected child, but also parents and unaffected siblings (UAS). Families in which a child has ASD report higher levels of stress (Eisenhower et al., 2005; Quintero & McIntyer, 2010), less frequent use of adaptive coping strategies (Hastings et al., 2005) and are at greater risk for psychological difficulties (Glasberg, 2000; Dunn et al., 2001). In particular, UAS face unique stressors. In an estimated 73% of ASD cases, the UAS becomes the caregiver after the death of the parents (Gidden, 2007). These sibling relationships have been described as less close, less reciprocal, and more stressful than other sibling relationships (Orsmond & Seltzer, 2007; Stoneman, 2007). In addition, siblings within affected families spend less time together compared to typical sibling pairs (Knott et al, 1995).
Objectives:
The present study aims to examine what UAS understand about autism and how their understanding affects the sibling relationship. We predicted that increased understanding of ASD would lead to improved ratings of the sibling relationship.
Methods:
The sample included 46 UAS (Mean age = 9.93). UAS completed an interview on their understanding of ASD (Glasberg, 2000) and self-report measures regarding the sibling relationship. Parents completed questionnaires on the their observations of the sibling relationship. To test our hypotheses that understanding of ASD would affect the sibling relationship, we conducted linear regressions with understanding of ASD predicting the sibling relationship.
Results:
For child-report, we found that understanding of ASD significantly predicted decreased overall satisfaction with the sibling relationship (p = 0.027, R^2 = 0.12; Fig 1) and decreased satisfaction with time spent with one's sibling (p = 0.047, R^2 = 0.087). Additionally, as understanding of ASD increased, perceptions of positive sibling behaviors decreased (p = 0.034, R^2 = 0.088) and perceptions of supportive behavior towards their sibling with ASD decreased (p = 0.033, R^2 = 0.112). Parent-report did not reveal a significant association between understanding of autism and sibling relationship.
Conclusions:
In contrast to our hypothesis, we found, across multiple measures of the sibling relationship, that as understanding of ASD increased, satisfaction with the quality of the sibling relationship decreased. There are many potential reasons for this unexpected finding. For example, knowledgeable parents may spend more time advocating for their child with ASD, which could result in less time with the UAS, or more pressure on the UAS. This interaction may cause UAS to feel frustrated with their sibling with ASD. This hypothesis is somewhat consistent with literature indicating that UAS often feel negative feelings (e.g., guilt, jealousy) about their sibling with ASD (Gray, 1998). Alternatively, UAS who have more knowledge of ASD may feel dissatisfied with the amount of time they get to spend with their sibling (e.g., they may wish to spend more time with their sibling with ASD). It is also possible that UAS with more knowledge are overly critical of their behavior towards their sibling with ASD. Our findings have wide-reaching implications for improving the sibling relationship and family dynamic.

94 **179.094** Autism Spectrum Disorder Traits and Parental Stress: The Moderating Role of Parental Self-Efficacy

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Background: The relationship between parenting stress and child behavior is a complex bi-directional process (Baker et al., 2003). Previous research has established that caregivers of children with Autism Spectrum Disorder (ASD) experience increased parenting stress as a result of unique parenting demands and child problem behavior (Davis & Carter, 2008; Estes et al., 2013). Positive self-concepts, specifically parental self-efficacy (PSE), may buffer stress in a number of contexts (Cieslak, Benight, & Lehman, 2008). While many studies examine parenting stress in relation to ASD, they often use parent self-report rather than objective measures in a laboratory setting. High-frequency heart rate variability (HRV) is a measure of autonomic functioning that is mediated by parasympathetic nervous system activity (Berntson, Cacioppo, Quigley, & Fabro, 1994), and has been used to indicate flexible emotional responding and psychopathological processes (Thayer & Lane, 2000; Kreibig, 2010).
Objectives: The present study aims to further explore the role of PSE as a moderator in the relationship between parental stress and ASD traits, utilizing a biological, unbiased measure of stress (HRV) within a controlled laboratory environment. Findings may have implications for parent training and intervention targets. It is predicted that PSE will act as a "buffer," decreasing the effect of ASD traits on parental stress that is measured physiologically with HRV.
Methods: The present study examined the stress parents of children with ASD experience and the way in which PSE may moderate the impact ASD traits have on this stress by using a physiological measure of stress. The sample included 41 mother-child dyads (32% ASD; 61% male, 7-12 years). ASD traits were determined by The Autism Spectrum Quotient-Child Version (AQ-Child; Auyeung, Baron-Cohn, Wheelwright, & Allison, 2007), parental stress was measured by baseline HRV using Polar Pro software, and PSE was measured by the Parental Sense of Competence scale (PSOC; Johnston & Mash, 1989). HRV was measured during a 3-minute baseline video to achieve a "vanilla" baseline (Jennings, Kamarck, Stewart, Eddy, & Johnson, 1992).
Results: Regression analyses indicated main effects for both ASD traits and PSE on maternal baseline HRV, such that increased HRV (i.e., reduced physiological stress) was related to higher ASD trait scores (β =1.40, p = .001) and reduced PSE scores (β = -.974, p = .003). However, the interaction term (i.e., PSExAQ) was not significant (β =.064, p = .12). Therefore, PSE did not significantly moderate the relationship between ASD traits and parental stress.
Conclusions: Â These findings suggest relationships of parental physiological stress with ASD trait severity and PSE. Specifically, heightened ASD trait severity and lower PSE were both associated with increased HRV. These results may illustrate the fact that parents whose children have more severe ASD and therefore, higher AQ scores, might have developed more adaptive coping mechanisms. However, the relationship indicating low PSE and increased HRV is unexpected. One potential explanation is that there may be some discrepancy in what HRV is truly measuring, and it might not be a truly accurate indicator of parental stress.

95 **179.095** Barriers and Facilitators to Physical Activity in Families Who Have a Child with ASD

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Background: Parents and caregivers of children with ASD's have been shown to have high levels of stress. Recent research has shown the benefits of physical activity for individuals with ASD's, but limited research has focused on the physical activity and leisure activity of families with ASD's.
Objectives: The purpose of this study was to explore barriers and facilitators families who have children with ASD's experience in accessing physical activity (PA).
Methods: This qualitative phenomenological study used semi-Structured interviews with 13 parents and/or caregivers to explore barriers and facilitators to participation in PA. Participants were recruited through local agencies who serve children with ASD's using a criterion-sampling approach. Interview questions focused around physical activity experiences of the family members individually and as a whole. Data were transcribed and coded deductively for themes within each data set and then between participants to find overarching themes to barriers and facilitators to PA for families who have a child with ASD.
Results: To be presented.
Conclusions: To be presented.

96 **179.096** Barriers to Technology Inclusion: Teens with ASD and Typically-Developing Peers

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Background:
Current standards and guidelines for creating accessible web and information technology have focused on people with visual, auditory, and motor differences. Some attention is now being paid to cognitive differences, but little attention has been paid to creating evidence-based guidelines for people with autism spectrum disorder (ASD). With the nearly ubiquitous use of technology among teens with autism and a desire to enter technology-involved careers, little research has been done to understand what programs (applications) are being used, whether teens with ASD can use them, and whether current design guidelines adequately address the diverse needs of people with ASD.
Objectives:
The purpose of this research was to understand which commonly-used applications are difficult for teens with ASD to use and to identify avenues for improvement.
Methods:
An anonymous 80-question survey was administered online to parents/guardians of ASD and typically developing (TD) children ages 13-17 living in the US with and without ASD. Participants were recruited through the Interactive Autism Network (IAN) and social media. The survey was administered during October and November 2015.
Results:
348 survey instances were completed: ASD=264 (76%); TD=84(24%). Male-to-female gender ratios for TD (1:1) and ASD (5.87:1) were in the expected range.
Three groups were used for analysis: ASD with normal-or-above intellectual ability (ASD-Average); ASD with lower-than-normal intellectual ability (ASD-Low); and TD. No TD teens were attributed with lower-than-normal intellectual ability. Logistic regression was used to compare program use and difficulty across groups, controlling for the child's age, gender, race (white/non-white), and ethnicity (Hispanic/Non-Hispanic).
In general, teens were using a wide variety of applications, with ASD-Low teens using fewer office/productivity applications and having more difficulty when using them than ASD-Average and TD groups. For entertainment applications, fewer ASD-Low teens were using and they had greater difficulty than the other groups. There was no significant difference between the groups in the use or difficulty of educational applications, which tend to be tailored for different skill levels. See Table 1.
We asked the parents of teens with ASD the open-ended question: *What advice do you have for people who design computers and other digital devices, computer applications, and web pages so that they could improve these technologies for your child?* A thematic content analysis revealed the following themes for the ASD groups, in order of frequency: interfaces should be simple, predictable, error free, accommodate motor differences, and be respectful and age-appropriate regardless of level of functioning. These themes are very much in line with the guidelines for people with cognitive and motor differences.
Conclusions:
Most of the teens in this study with ASD were active technology users. When programs were tailored to the needs of the ASD-Low teens, they are able to use them. People who design office/productivity and entertainment applications should provide simplified versions so that people with lower intellectual ability and cognitive differences can have equal access to occupational and entertainment opportunities. Adherence to current accessibility guidelines for people with cognitive and motor differences will help increase technology access for people with ASD.

97 **179.097** Behaviour Problems and ASD Characteristics Predict Parent Competency and Caregiver Strain

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Background: Research investigating factors that predict parenting stress show mixed findings. Some researchers suggest that autism spectrum disorder (ASD) characteristics are an important determinant of parenting stress (Huang et al., 2014); however, others suggest that behaviour problems may impact parenting stress more than ASD characteristics (Zaidman et al., 2014). Behaviour problems associated with ASD are common and heterogeneous; many children with ASD have a co-occurring diagnosis of a disruptive behaviour disorder, such as conduct disorder or oppositional defiant disorder (Kaat & Lecavalier, 2013). As a result, it can be difficult to determine the degree to which ASD characteristics or behaviour problems contribute to perceived levels of parent competency and caregiver strain.
Objectives: 1) To investigate whether behaviour problems and ASD characteristics predict significant impairments in parent sense of competency and caregiver strain; and 2) investigate the interaction between behaviour problems and ASD characteristics; and 3) investigate the interaction between behaviour problems and ASD characteristics with child's sex.
Methods: Two hundred and forty six caregivers (*M*=44.05; SD=8.24), rated their child's ASD symptoms on the Autism Spectrum Quotient adolescent short form (AQ-10), and behaviour problems on the Brief Child Family Phone Interview (BCFPI). Parents reported levels of their own Parent Sense of Competence (PSOC) and Caregiver Strain (CGSQ).
Results: Hierarchical multiple linear regression analyses indicated that high levels of behaviour problems and ASD characteristics each contributed significantly to low levels of PSOC and high levels of CGSQ. ASD characteristics significantly accounted for an additional 2.1% of the variance in PSOC and 5.8% of the variance in CGSQ.
Further, the interaction between behaviour problems and ASD characteristics was significant for CGSQ, accounting for an additional 1.4 % of the variance in CGSQ scores. When ASD characteristics are low, parents report increasing levels of caregiver strain as their children's behaviour problems increase ($p < .001$). When ASD characteristics are high, parents report elevated levels of caregiving stress even when behaviour problems are low ($p < .001$); caregiving stress then steadily rises as a behaviour problems increase in this population.
The sex by behaviour problems interaction term was significant. Results showed that caregiver strain increases as behaviour problems increased among males and females ($p < .001$); however, the rate of increase in caregiver strain in relation to behaviour problems was steeper for females ($p < .001$).
Conclusions: Â Behaviour problems and ASD characteristics predict both parent sense of competency and caregiver strain. However, ASD characteristics appear to be a better predictor of parent competency and caregiver strain than behaviour problems. An interaction between behaviour problems and ASD characteristics was found for caregiver strain suggesting that the rate of increase in caregivers' strain in relation to behaviour problems was steeper when ASD characteristics were low as compared to high, yet parent sense of competency was unaffected. In addition, the rate of increase in caregiver strain in relation to behaviour problems was steeper for females as compared to male children, yet parent sense of competency was unaffected.

98 **179.098** Being a Spectrum Mother: A Mixed Methods Study

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Background: Parenting a child with autism can be challenging for both parents. Previous work in this area has highlighted quality of life issues for parents of children with Asperger's syndrome and autism. Mothers in particular have been found to experience significantly more stress with a reduced quality of life. However, little to no work to date far has established the specific needs and the challenges of women who are on the spectrum themselves.
Objectives: In this study, we examine specific experiences and key needs of spectrum mothers in negotiating social expectations, childbirth, everyday parenting, and in accessing health and education services.
Methods: This study included 35 spectrum mothers (with an autism diagnosis or self identified) and 23 non-spectrum mothers. In order to explore issues in open dialogue, varied qualitative methodology featuring focus groups, interviews and questionnaires were used to obtain information on particular issues that each mother faces. Quantitative data were also collected and will be discussed. Key areas of questioning included issues related to pregnancy, being a new mother, development of the child and a discussion on the kind of assistance that would be most helpful.
Results: Qualitative and quantitative data analysis methods were employed.
In the area of pregnancy, key issues identified in the spectrum mothers included:

- Lack of clarity in communication between mothers and healthcare professionals.
- Difficulty with unfamiliar and changing environments.
- The necessity of having to interact with other people, including other mothers, health practitioners and hospital staff.

For spectrum mothers, the challenges of being a new mother included:

- Difficulties in accessing mother and toddler groups.
- Health visitor and other medical checks.
- Confidence in parenting skills in both the practical and emotional aspects of being a parent.

As children grow, spectrum mothers reported:

- Lack of confidence in parenting skills, particularly in the area of emotional responsiveness.
- Difficulties when interacting with teachers, other parents and accessing groups for extracurricular activities for their children.
- Extreme exhaustion.
- Feelings of isolation.
- Fears and realities of being judged, both with and without disclosure of autism status.

Spectrum mothers report that the following would help:

- Autistic-specific advice on pregnancy and childbirth; guidance as a new parent.
- Support for being a good social role model for children, despite individual difficulties.
- Ideas for a daily routine.

Conclusions: The findings from this study underline the specific challenges faced by spectrum mothers. These challenges not only affect spectrum mothers, but also have implications for outcome in children as the spectrum mothers underline worries about how their autism affects their children, such as access to group activities, interactions with other families, real or perceived judgemental attitudes from others and management of the parent-teacher relationship.
Additionally, potential strategies for improving the service provision, proposed by spectrum mothers, are described. It is hoped this study will provide a framework of specific areas of difficulty for spectrum mothers, and that future work will lead to the development and identification of specific support mechanisms for spectrum parents and their children.

99 **179.099** Beliefs about Causes of Autism and Current Vaccine Hesitancy: Comparisons Across FOUR Parent Groups

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Background: Â Unfounded fear about a connection between childhood vaccines and autism spectrum disorder (ASD) has been proposed as a leading reason behind a growing number of vaccine delays and refusals. An estimated 20-30% of parents are vaccine hesitant—meaning they have considerable vaccine concerns and may delay or refuse one or more vaccines. Identifying groups of parents more likely to become vaccine hesitant and factors that predict vaccine hesitancy are key to the design and success of tailored, preemptive vaccine-safety educational strategies.
Objectives: To (a) compare parents' beliefs about causes of their children's developmental delays/chronic illness and rates of vaccine hesitancy among parents of children in four groups: those with ASD (ASD), those for whom ASD was *ruled out*(ASD-RO), those with a diagnosed rheumatoid disorder (RD), and those in the general pediatric population (GP); and (b) identify factors that may differentially associate with vaccine hesitancy across groups.
Methods: Data were collected from 165 parents of children seen at the Autism Center at Texas Children's Hospital and enrolled in a research registry (76% ASD; 24% ASD-RO). Families who had agreed to be contacted about new studies were mailed packets that contained a cover letter, a *Parent Attitudes About Childhood Vaccines* questionnaire (PACV; measure of vaccine hesitancy), a *Revised Illness Perception Questionnaire*(IPQ-R; measure of attributions about children's diagnoses and etiological beliefs), and a demographic form. Clinical diagnoses (ASD or ASD-RO) were extracted from the electronic medical record by one co-author and validated by a second. A logistic regression model was used to estimate the odds ratio for vaccine hesitancy with 95% confidence intervals. Variables significant at the 0.20 level in the univariable analysis were included in the multiple logistic regression model, adjusting for diagnostic group (ASD or ASD-RO). Data collection from the RD and GP groups is currently ongoing, with comparable analyses planned.
Results: Overall, 39/165 (23.6%) of parents agreed that toxins in vaccines caused their child's developmental difficulties, while 40/165 (24.2%) were vaccine hesitant (PACV score ≥ 50). Compared to parents in the ASD-RO group, parents in the ASD group were more likely to believe that vaccines contributed to their child's developmental difficulties (27.0% vs. 12.8%) and significantly more likely to be vaccine hesitant (28.6% vs. 10.3%, Fisher's p< 0.02). The odds of being vaccine hesitant were 2.8 times higher among parents endorsing environmental pollution as a cause for their child's difficulties (95%CI: 1.1—7.6) and 12.8 times higher among parents endorsing toxins in vaccines as a cause (95%CI: 4.5—36.2), which were the only factors maintaining statistical significance in the full model (Figure 1). Additional results with the RD and GP groups are forthcoming.
Conclusions: This comparison between the ASD and ASD-RO groups is interesting in that children in *both* groups had been referred for *possible* ASD; final diagnosis—ASD or not ASD—was a distinguishing factor associated with current parental vaccine hesitancy. Comparisons among the RD and GP groups will further elucidate whether a child's ASD diagnosis and/or other factors confer particular risk for becoming vaccine hesitant.

100 **179.100** Broader Autism Phenotype and Perceived Social Support As They Relate to Pro-Social Behavior in Typically Developing Siblings of Children with Autism Spectrum Disorder

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Background: In light of difficulties associated with core symptoms of autism spectrum disorder (ASD), as well as the behavioral issues that often accompany ASD, having a child with ASD as a family member may be challenging. Research on parents of children with ASD has found negative outcomes, such as stress, depression, and anxiety (e.g., Karst & Van Hecke, 2012). With respect to outcomes for typically-developing (TD) siblings of children with ASD, the results are mixed (e.g., Meaden et al., 2010). Some research has found increased mood and behavior problems in TD siblings (e.g., Bitsika et al., 2015), whereas others have found no evidence for elevated emotional and behavioral difficulties (e.g. Tomeny et al., 2012), and still others have found positive outcomes (e.g., Macks & Reeve, 2007). Given the mixed findings for TD siblings of children with ASD, research should explore factors related to positive outcomes, such pro-social behavior, in these siblings.
Objectives: The present study sought to 1) explore pro-social behavior in TD siblings of children with ASD, and 2) examine broader autism phenotype (BAP) and TD siblings' social support as they relate to TD siblings' pro-social behavior, while controlling for family stressors (parental stress and ASD symptom severity of the child with ASD).
Methods: Â Participants included 113 parents and TD sibling [ages 11 to 17 (M = 13.32, SD = 1.81)] of a child with ASD [ages 3 to 17 (M = 11.98, SD = 3.29). Parents completed the Questionnaire on Resources for Stress – Short Form as a measure of parental stress, the Children's Social Behavior Questionnaire about their child with ASD to assess ASD symptom severity and about their TD child to assess BAP symptoms, and the Strengths and Difficulties Questionnaire (SDQ) to assess TD sibling pro-social behavior. TD siblings completed the SDQ and the Child and Adolescent Social Support Scale to measure their pro-social behavior and perceived social support, respectively.
Results: A series of partial correlations were conducted controlling for ASD symptom severity and parental stress. While holding these covariates constant, pro-social behavior was negatively correlated with BAP symptoms (r = -.27, p = .004 for self- and r = -.57, p < .001 for parent-report), per both reporters. Alternatively, pro-social behavior was positively correlated with TD sibling social support for both reporters (r = .38, p < .001 for self- and r = .21, p = .03 for parent-report). Additionally, parent- and self-reported pro-social behavior were correlated, r = .43, p < .001.
Conclusions: Overall, TD siblings reported pro-social behavior within the Normal range based on normative data (Goodman, 1997), indicating the majority of TD siblings in the present sample are exhibiting some positive behavioral outcomes, despite the potentially challenging factors associated with having a sibling with ASD. Greater pro-social behavior was related to fewer BAP symptoms and greater perceived social support, as reported by both parents and the TD siblings. Although these results are preliminary in nature, they emphasize that future research should examine predictive factors of positive outcomes for TD siblings of children with ASD.

101 **179.101** Caregivers' Voices Regarding Implementation of a Parent-Mediated Early Intervention for Toddlers with ASD

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Background: Caregiver-mediated early intervention models for families of toddlers with autism spectrum disorder (ASD) appear to be a viable intervention option. However, these models have been met with mixed findings regarding child outcomes (Oono, Honey, & McConachie, 2013). Due to the nature of these models in which caregivers are implementing the interventions, little is known about what actually happens when the interventions are implemented during these routines and activities. The field of implementation science referring to the study of how evidence based interventions are implemented in the intended manner, specifies the inclusion of stakeholders in the development and improvement of intervention models. However, caregivers, who are stakeholders *and*implementers of caregiver-mediated early intervention models often are not included in the model development. Thus, it is crucial to understand a.) how feasible caregivers find the intervention and b.) what caregivers experience implementing interventions within their daily routines.
Objectives: Â This presentation will share results from a social validity assessment and an interview study with caregivers who participated in a caregiver-mediated intervention. The specific research objectives include: 1.) Describe caregivers' views on feasibility of the intervention and successes and barriers encountered in implementing the intervention 2.) Based on caregivers' views and experiences, recommendations will be made regarding how caregiver-mediated early intervention models may be more feasible.
Methods: Â Following participation in a randomized controlled trial testing the efficacy of Joint Attention Mediated Learning (JAML), data were analyzed. While most caregivers rated the social validity high, there was some variation, which deems further exploration into caregivers' lived experiences in implementation. A purposive sample of caregivers who rated socially validity high and low, will be contacted to participate in a follow-up interview regarding their experiences implementing JAML including its applicability to their daily routines. Interview data will be compared with the data from the social validity forms. Interviews will be audio taped, transcribed, and systematically coded using a constant comparative process to identify themes that emerge from the caregivers' challenges and successes in intervention implementation.
Results: Â Data from social validity forms completed by caregivers in the intervention group indicated that 93% of participants strongly agree that the intervention is important, 63% strongly agree that they enjoyed their caregiver role in the intervention, and 82% strongly agree that they received the optimal amount of support. Caregivers commented positively about components of the intervention such as the systematic instruction and use of videos in the training. Interviews will probe further into what actually happened during implementation and how that relates to social validity. Results will include identified themes in regard to implementation experiences emerging from caregivers interviewed.
Conclusions: In designing interventions, a consumer driven approach is needed in order to truly maximize optimal child and family outcomes. Thus, learning from caregivers what they actually experience implementing interventions would strengthen intervention design and follow through. Key components that were helpful and/or challenging to caregivers will be reported and conclusions will be made based on the themes that emerge from the follow-up interviews and how it relates to social validity.

102 **179.102** Challenges for Females with Autism: A Parental Perspective

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Background: An ASD diagnosis can be four times more common in males than in females (Fombone, 2011). However, it is suggested that there is a greater prevalence of autism amongst females than statistics report (Attwood, 2007). A wide range of hypotheses regarding the etiology of sex differences has been proposed, including genetics, brain function, and low validity of assessment tools in detecting autism in girls (Rivet&Matson, 2011b). For these reasons, studies investigating the experiences and needs of individuals with ASD have largely focused on males (Hellemans et al. 2007) and those studies that have included females have involved mixed-sex samples, preventing detailed exploration of female-specific issues (Nichols & Blakeley-Smith 2010). More recently it was shown that although some of the issues faced by females with ASD are similar to those of males with ASD, there seem to be some characteristics more unique to females' experience and their families (Cridland et al., 2014). Hence, there is a largely unaddressed need to identify the specific needs of females with ASD.
Objectives: This study investigates parents' perspectives on the challenges that their daughters with ASD face in different aspects of their lives.
Methods: Â In total, 40 parents of 40 females with autism (age range=4-29 years) participated in the study. Five separate, 2-hours long focus groups were conducted, in which 7-10 participants engaged in semi-structured discussions. Field notes were analyzed using thematic analysis (Krueger&Casey, 2000) to identify data that related to predefined categories (challenges). Relevant data from all field notes were then read and re-read to identify patterns and subthemes within each predefined category.Â Through this iterative process, we were able to select the most relevant sub-themes while ensuring that all material could be sub-classified. Once the coding scheme had been established, the notes were subsequently double-coded by two researchers to ensure consistency of approach.
Results: The focus groups generated rich information and revealed several key challenges distinctly experienced by females with ASD. These were classified as themes relating to 'social communication and social interactions', 'restricted, repetitive patterns of behavior, interests or activities and hypo-/hyper-sensitivity to stimuli' and 'life skills'. Some of these points were similar to those experienced by males with ASD, such as sensory sensitivities in relation to loud noises, challenges of learning personal boundaries in interactions with others, difficulties following the demands of hygiene routines and impact of receiving late diagnosis. However, other issues discussed were of particular relevance to girls with ASD, such as difficulties socializing with other girls (both with ASD and typically developing), sex-specific puberty issues, and perceptions of sexual vulnerability.
Conclusions: This study highlights an important research area and is a preliminary step towards understanding the experiences of females with ASD and their families. However, there is a need for further research investigating female autism presentation through direct examination of the females themselves (Lai et al., 2015). Taking this research direction provides a greater potential to contribute to the well-being of females with autism, build meaningful support services and also add to our general understanding of autism.

103 **179.103** Characteristics, Needs and Outcomes of People with ASD Receiving Medicaid-Funded Long-Term Supports and Services (LTSS) While Living in the Home of a Family Member

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Background:
Of the 1.2 million LTSS recipients with intellectual or other developmental disabilities (IDD) served by state IDD agencies in 2014, more than half (56%) lived in the home of a family member, 11% lived in a home of their own, and 33% lived in a group setting or with a host or foster family (Larson, et al., 2016). In the 2014/2015 National Core Indicators (NCI) survey, 16% of the of 25,772 adults served by state IDD agencies in 33 states or regions who were interviewed had ASD (Human Services Research Institute, 2016). In the 2013/2014 NCI Adult Consumer Survey (ACS), 45% of the adults with ASD receiving IDD services lived in the home of a parent or relative. Of the 6,955 2013/2014 NCI family survey respondents from 18 states 11% had an adult or child family member with ASD (80% had a family member with ID and 9% had a family member with another IDD; Anderson, et al., 2016).
Objectives:
Our objective is to describe similarities and differences in characteristics, needs and outcomes for individuals with ASD and those with other IDDs who live with a family member while receiving Medicaid funded LTSS.
Methods:
This presentation describes characteristics, needs and outcomes of people with Autism Spectrum Disorders (ASD) based on secondary data analyses using the 2014/2015 NCI ACS (describing service recipients and experiences) and family surveys (describing family experiences and outcomes).
Results:
Preliminary analyses of 2014 NCI family surveys found many similarities across disability groups (ASD, ID, and other DD). Key differences included: people with ASD were less likely to receive SSI/SSDI or out-of-home respite services or to have a service plan that included all needed services, and families were less likely to report that they had say in who provided direct supports. This presentation summarizes key findings from more detailed analyses of these differences controlling for known covariates.
Previous analyses of NCI ACS results found that adults with ASD were younger, less likely to communicate using speech, and had different co-morbid conditions than other adults with IDD (Hewitt, et al., 2012). Adults with ASD were also less likely to be employed in community settings (Nord, et al., 2016).This presentation summarizes results from analysis of the most recent NCI data on differences in key outcomes for LTSS recipients living with family members who have or do not have ASD controlling for differences in known covariates.
Conclusions:
Only a few national data sources describe the characteristics and needs of people with ASD who receive LTSS. The National Health Interview Survey allows identification of children but not adults with ASD in its sample. The American Community Survey does not identify people with ASD. The NCI survey program identifies respondents with or without ASD. Data from the 2014/2015 NCI surveys were used to examine the characteristics, needs and outcomes of LTSS for people with ASD amongst people with ASD receiving LTSS through state IDD agencies.

104 **179.104** Characterizing the Representation of and Conversation about ASD Treatments on Twitter

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Background: The process by which parents of young children with autism spectrum disorder (ASD) make treatment decisions is complex and nuanced, often rooted in information retrieved from the internet, and not necessarily with attention to scientific support for treatment options. Current research suggests that information on ASD that is available on websites lacks adequate reference to scientific support. While websites provide health information, social media platforms including Twitter are now additional forums for the exchange of content and opinions related to health. Research has not yet been conducted regarding the spread of information related to ASD treatment recommendations via Twitter.
Objectives: The objective of this study was to characterize the information networks, as well as the content and quality of such information shared on Twitter, specifically with respect to the dissemination of evidence-based recommendations for ASD treatment for young children. We aimed to characterize the content of linked sources from tweets related to ASD treatment recommendations and to identify opinion leaders in networks of users tweeting about ASD treatment recommendations.
Methods: A search of Twitter messages (tweets) was conducted using the social media analysis tool, NodeXL. All tweets shared during a 1-week period in October 2016, were filtered using keywords related to intervention for young children with ASD (AUTISM or ASD and TREATMENT or INTERVENTION or THERAPY or CURE or CARE or HELP). All sources linked to from the extracted tweets were coded with regard to type of source and content. Those Twitter accounts that were most prominent within this network of shared tweets were identified using NodeXL automated analytics of user networks.
Results: 894 tweets met the search criteria and included a URL. Tweets were excluded if their linked URL did not address an intervention, or if the intervention was specified to be inappropriate for children under age 3. Of the remaining 71 unique URLs, a breakdown of source type was as follows: 59% were an 'unbiased' presentation of information about a treatment; 21% provided a personalized testimonial; 9% advertised a therapy product; 4% linked directly to a current event regarding a treatment; 3% linked directly to a peer-reviewed journal article; 2% linked to a crowdsourcing advice page. In terms of the content, 54% of sources described or endorsed a complementary and alternative medicine (see table). Finally, of the top-ten users who were most frequently mentioned by other tweets, 2 user accounts belonged to advocacy organizations (e.g., Autism Speaks), while 4 of these top-ten accounts belonged to self-advocates.
Conclusions: The rationale for this study was to provide evidence of the social media influences that contribute to ASD treatment decisions. Results of this preliminary study indicate that information readily available to parents on Twitter regarding ASD treatments includes a widely varied set of options offered by both stakeholders and providers. However, the significant representation of complementary and alternative medicines that have been identified as lacking scientific evidence suggests that further research is needed to develop methods for using social media to make evidence-based recommendations as accessible as alternative recommendations.

105 **179.105** Childhood Victimization in a National Sample of Youth with Autism Spectrum Disorders

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Background: There are a number of hidden populations in the United States whose victimization goes undetected and unreported.
Objectives: This studyaims to assess the victimization experiences of one such population: American children diagnosed with autism spectrum disorders (ASDs).
Methods: Utilizing the Juvenile Victimization Questionnaire (JVQ), this study obtained past-year and lifetime prevalence rates of interpersonal violence in a sample of children with ASDs (N5262).
Results: Results showed that almost 89% of these children had experienced an incident of victimization in their lifetime, while almost as many (82.1%) had experienced an incident within the last year. Among those who had been victimized once within the last year, 92% experienced at least a second victimization within that same time period, pointing to significant levels of poly-victimization. Risk ratios confirm that if a child experiences an incident of victimization in the past year, s/he is at risk to experience another type of victimization during that time frame, no matter what type of initial victimization exposure was examined.
Conclusions: Previous research specifically addressing the victimization of children with ASDs in the United States has been limited and often focuses on a specific form of victimization, such as bullying. Implications include considering the impact of exposure to multiple forms of victimization and addressing the possibility of long-term trauma resulting from chronic exposure to victimization.

106 **179.106** Comorbid Anxiety Disorders in Young Children with ASD: Parent and Teacher Report

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Background:
Children with ASD often experience high levels of anxiety. Indeed, a meta-analysis conducted by van Steensel et al. (2011) revealed that 40% of children had at least one comorbid anxiety disorder. Symptoms of anxiety include fear of separation from parents, resistance to change, crying easily, tenseness, shyness, and irritability (Brereton et al., 2006). However, most previous studies have not focused on young children with ASD who are transitioning to early schooling, when a comorbid anxiety disorder compounds the academic and other risk factors these children experience as they transition to school (Perry & Weinstein, 1988).
Objectives:
This study looks at the prevalence and presentation of comorbid anxiety in young children with ASD who are transitioning to school. Specifically: (1) What is the prevalence of anxiety problems in children ages 4 to 7 years? (2) How does anxiety manifest in preschool (ages 4-5) and in the early school grades (ages 6-7) as reported by parents and teachers? (3) Are there differences between parent and teacher reports of anxiety symptoms?
Methods:
Participants in this study included 180 children ages 4 to 7 years old (147 boys, 33 girls) and their parents and teachers, who were participating in the longitudinal, IES-funded Smooth Sailing study. Behavioral information was collected from parents and teachers using the Child Behavior Checklist – Parent Report and the Teacher Report Form, respectively (CBCL and C-TRF; Achenbach & Rescorla, 2001). This study examined narrow band scores in children who scored in the clinically significant range on the CBCL/TRF.
Results:
Parents reported that 31% of preschool children and 50% of school-aged children were experiencing clinically elevated anxiety. Teachers reported much lower rates, identifying clinically elevated anxiety in less than 5% of preschool children and 30% of school-aged children. Parent and teacher reports of anxiety were uncorrelated for both preschool children ($r = -.11$, $p = .40$) and school-aged children ($r = .15$; $p = .20$). Parents of preschool children with clinically elevated anxiety problems reported that their children frequently exhibit dependence, reluctance to sleep alone, and fears. These behaviors were marginally more frequent, per parent-report, than worrying or separation anxiety . Parents of school-aged children with clinically elevated anxiety problems reported that fears and nervousness were frequent behaviors. These behaviors were significantly more frequent, per parent-report, than worrying (. Similarly, teachers of school-aged children also reported nervousness as a frequent behavior. However, they rated fears as occurring much less frequently than parent report of fears.
Conclusions:
Findings were congruent with the literature that reported a discrepancy between parent and teacher report of behavior (Stratis & Lecavalier, 2015), although here we identified specific internalizing behaviors on which reporters differed. Overall, teachers reported less frequent behaviors indicative of anxiety. Lack of recognition by teachers of important internalizing behaviors, such as anxiety, can delay access to intervention. Implications of the specific behaviors reported by parents and teachers during preschool and the early school years will be discussed.

107 **179.107** Comparing Methods to Increase Participation in Spanish Language ASD Parent Training

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Background: Â Training in Applied Behavior Analysis for parents of children with ASD can be a critical support for both parents and their children (Bearss, Johnson, Smith, Lecavalier, & Swiezy, 2015). Parent trainings have been shown to be effective in helping improve problem behavior (Bearss et al., 2015), reducing feeding issues and parental stress (Sharp, Burrell, & Jaquess, 2014), and increasing children's skill generalization across settings (Ingersoll & Dvortcsak, 2006). Unfortunately, however, these trainings are not often well attended, and programs in Spanish have been even less frequently examined.
Objectives: Â The current study seeks to compare two methods for engaging participants in a parent training intervention program conducted in Spanish, for Spanish-speaking parents of school-aged children with ASD.
Methods: Â This study was conducted at a clinical site where 75% of families were exclusively Spanish-speaking. Twenty families were recruited who had at least one child with ASD, aged 6-8 years old. Seventeen families ultimately participated in the training program in two separate group models (n=9 in model 1 and n=8 in model 2). In the first model, the interventionist assessed all families, and the intervention included 6 group sessions, followed by 4 individual sessions. In the second model, separate staff assessed families, and the intervention included 4 group sessions, followed by 4 individual sessions. Content was the same in both models, and focused on teaching ABA terms, strategies, and application for issues with their own children. Families completed both parent and child measures before the training began (Vineland-II, Aberrant Behavior Checklist, Parent Stress Inventory, Home-Situations Questionnaire, etc.), including a diagnostic evaluation (ADOS-2 and KBIT-2) with their child. Throughout the intervention, ABC data and parent implementation efforts were recorded, and parents repeated the self-report surveys at the end of the training.
Results: Participating children had a variety of behavioral challenges, and each family who attended sessions consistently (in either model) successfully collected information on their child's behavior, and reported changes in their use of strategies and reduction in their child's behavior as a result. Parent engagement was significantly higher in the first model (6 group and 4 individual sessions) at 84.6% than in the second model (4 group and 4 individual sessions) at 43.8%. Cultural adaptations to the intervention were needed to increase participation in both models, including offering childcare, dinner for participants and children, and extending time for social engagement, but more relationship building opportunities were included in the first model.
Conclusions: Â It is important to include relationship building opportunities before and throughout parent training interventions, especially for Spanish speaking families with children with ASD. The shorter number of group sessions in model 2 hindered the development of parent-to-parent and parent-to-interventionist relationships that appeared to support attendance in model 1. In this particular population, there was a wide variety of parent knowledge and advocacy, which is increasingly difficult with the language barrier. Having peer and interventionist support beyond the curriculum were critical pieces of the intervention delivery.

108 **179.108** Comparing Parent to Student Report Regarding Technology Use By Adolescents with Autism in School and Home Settings

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Background: It has been observed that many children with autism have an affinity to screen based technology and research has examined their use of technology for entertainment, in particular to play video games and watch animated movies. It is not well understood how technology is used to support independence and learning and social interactions. Hedges et al., (under review), found in a recent survey of high school students with autism (n=472) that a majority of respondents reported using technology to enhance their learning, increase their social interactions, and to help reduce stress. This current study sought to confirm those findings by asking similar questions to the parents of the student study participants.
Objectives: To compare parent perspectives to their children's on the use of technology, in particular, what they perceive are its benefits and challenges.
Methods: Paper surveys were completed by 321 parents of high school students with autism receiving special education services across 3 states in the US (California, North Carolina, Wisconsin). The questionnaires covered topics related to their children's technology use at home and at school. Technology was described as computers, cell phones, tablets, etc.
Results: Mirroring their children's report, the majority of parents (91%) said their child is "good" at using technology and 66% said they "definitely" consider it an area of strength. Like their children, most respondents see their teen having a career or job using technology in the future. Similarly, 97% report their child uses technology to communicate or socialize including texting, email, and social media. Almost half of respondents felt that online learning would be a good way for their child to learn. Parents (83%) reported a common use of technology by their children included listening to music to help reduce stress or relieve anxiety.
Â In contrast to the benefits of technology use by teens with autism, 71% of parents (compared to 58% of students) reported that technology can distract their teen from learning and 84% said that their teen's technology use can be excessive.
Conclusions: Parent reports of benefits of technology use along with reports of excessive use and distraction from learning were similar to what their children reported. Educators should consider the benefits of providing access to technology tools for their students with autism to help increase independence, communication, and social interactions. They may also need to consider ways to mitigate the distracting aspects of technology.Â Parents may want to consider setting limits on technology use to help their children learn to control excessive use.

109 **179.109** Compassion Meditation for Therapists of Individuals with ASD: Effects on Stress and Cultural Competence

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Background:
Health care workers are at a higher risk of experiencing severe distress, burnout, and mental and physical illness than employees of any other industry (McVicar, 2003). This risk has been directly linked to adverse consequences for the quality of care that is provided to patients (Irvin et al., 2009). Comparatively, very little is known about the experience of health workers in ASD. Whereas the practice of mindfulness meditation is reportedly associated with stress reduction in several populations, including health care professionals (Goodman Schorling, 2012). We are not aware of any studies describing mindfulness or compassion based interventions for therapists of individuals with ASD.
Objectives:
The goal of this research is to pilot-test Cognitively Based Compassion Training (CBCT), a mindfulness and compassion meditation protocol developed at Emory University and empirically validated in other populations, with therapists of children with ASD in order to reduce stress and burnout and icrease their social competence.
Methods:
Participants were 22 healthy volunteers working with individuals with ASD at the Marcus Autism Center. The experimental group consisted of 12 participants (Age: $M \pm SD$ = 26.33±1.16; 10 females) who received CBCT over the course of 8 weeks and the control group included 10 participants (Age: $M \pm SD$ = 31.60±5.72; 10 females) who were on a wait list and received no intervention. They all completed several measures pre- and post-test: stress and burnout (Perceived Stress Scale or PSS, Maslach Burnout Inventory or MBI, and Brief Symptom Inventory or BSI-18), acceptance (Acceptance and Action Questionnaire or AAQ), empathy and compassion (Interpersonal Reactivity Index or IRI), behavioral flexibility (Mindful Attention Awareness Scale or MAAS, and Behavior Rating Inventory of Executive Function or BRIEF-A), and relational competence (Cultural Competence Checklist or CCC).
Results:
Paired *t*-tests were utilized to evaluate pre- to post-test changes in scores at the .05 significance level. At post-test, the experimental group reported significant improvements on the PSS [T1: $M \pm SD$ = 22.33±8.14; T2: $M \pm SD$ = 13.17±6.37; $t(5) = 5.33$], IRI Personal Distress Scale [T1: $M \pm SD$ = 18.17±3.19; T2: $M \pm SD$ = 15.50±3.15; $t(5) = 3.16$], and CCC [T1: $M \pm SD$ = 60.67±20.62; T2: $M \pm SD$ = 58.00±18.61; $t(5) = 2.61$]. The experimental group also reported a marginally significant improvement at post-test on the AAQ [T1: $M \pm SD$ = 16.33±3.50; T2: $M \pm SD$ = 11.67±3.27; $t(5) = 2.47$, $p = .057$]. There were additional significant improvements on the raw scores corresponding to the BRIEF-A Shift, Initiate, and Working Memory subscales and in the BSI Depression and Anxiety subscales ($p < .05$). The control group reported no significant changes from pre- to post-test on all measures.
Conclusions:
These results highlight the vulnerability of those professionals, with a potential impact on individuals under their care, and the need to address such vulnerability and its effects using a systematic empirically-based approach. CBCT may be a feasible training for therapists of children with ASD, as it has been demonstrated for the parents of these children elsewhere, with potential benefits on their stress and cultural competence. A randomized controlled trial should test its efficacy under controlled conditions.

110 **179.110** Cross-Sectional Comparison of IEP Quality for Transition Age Youth with ASD and Young Children with ASD

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Background:
The Individuals with Disabilities Education Act (IDEA) mandates all students receiving special education services have an Individualized Education Program (IEP) (IDEA, 2004). Even though there is an increase in students receiving school services for autism spectrum disorder (ASD), there is little known about IEP quality of students with ASD (Wilczynski et al. 2007). For young children, research suggests a need for more "individualized" IEPs that take into account critical areas of the development of social, communication, and independent work skills. For older students who are transition age (16-22), very little is known about IEP quality. Despite a lack of research, data suggest that IEPs for young children and transition age youth are far from best practice, often lacking individualized and measurable objectives.
Objectives:
To (i) conduct a cross-sectional comparison of IEP quality of transition age youth (16-22) with young students (3-9) with ASD and (ii) describe IEP quality of transition age youth in relation to an adapted national measure of postsecondary quality transition planning.
Methods:
Special education teachers of 35 young students with ASD (3-9 years) and 7 transition age students (16-22 years) were recruited as part of larger study. Additional data collection from 18 transition age students will be completed by November 2016, adding to the richness of this study sample. An IEP quality measure for students with ASD was developed based on IDEA requirements for IEPs and National Research Council (NRC, 2001) recommendations for teaching students with ASD. An Indicator 13 checklist developed by the National Secondary Transition Technical Assistance Center (NSTTAC, 2012), was adapted to measure postsecondary planning for transition age youth with ASD. Descriptive statistics were generated for each of the IDEA and NRC indicators and for the overall score on the IEP Evaluation Tool and Indicator 13 in order to assess quality. Higher scores reflected better quality.
Results:
Comparison of IEP Quality: IEP quality based on IDEA recommendations was higher for transition age youth while IEP quality based on NRC recommendations was higher for young children. IEPs for transition youth have less diverse goals with more focus on organizational/work (100%) and basic cognitive skills (42.9%) while IEPs for young students were more diverse and included organization/work (88.5%), academic (71.4%), communication (85.7%), social (80%), and fine and gross motor skills (65.7%).
IEP Quality in Relation to Transition Planning: Assessment of Indicator 13 recommendations for planning for postsecondary outcomes- education and training, employment, and independent living- indicated that all transition age youth had postsecondary goals related to either education/training or employment. However, only 57.1% of students had a post-secondary goal related to independent living. Additionally, only 25% of IEPs for transition age youth described a method of goal measurement.
Conclusions: IEP quality for students with ASD, both for young students and transition age youth show inconsistencies and areas needing improvement. IEPs for transition age youth need to include measurable and well-defined independent living postsecondary goals.

111 **179.111** Defining Stress and Crisis As Experienced By Parents of Children with Autism Navigating Intervention: Sub-Analysis of a Qualitative Study

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Background: Â Sources of stress associated with parenting a child with autism have been widely documented. Sources of stress attributable to navigating autism intervention, however, have received less attention. Stress has been associated with serious consequences for parents, such as anxiety and depression. These can interfere both with parental functioning, and parents' crucial role as navigators of intervention to address diverse autism-related concerns—endangering wellbeing of the autism unit. To our knowledge, stress and crisis have rarely been directly studied, and remain conceptually undefined, specifically from parents' perspectives with reference to their process of navigating intervention.
Objectives: This work is a sub-analysis of a large qualitative study whose aim was to explain how Ontario parents of children with autism navigate intervention. The purpose of the sub-analysis is to characterize and conceptually define stress and crisis, as experienced by such parents.
Methods: Â A qualitative grounded theory study was conducted to explain, in depth, the social psychological process parents of children with autism use to navigate intervention. Data comprised primarily 45 audio-recorded and transcribed intensive interviews with 9 professionals and 32 parents from urban and rural regions across Ontario with maximally varying perspectives; data also included documents (e.g., parent- and professional-authored books). Data collection and verification of the evolving categories proceeded iteratively according to theoretical sampling informed by ongoing analysis. Analysis consisted of constant comparison employed in coding and concept development, analytic memo writing, and final integrative writing on the topics of stress and crisis, throughout which we ensured findings were grounded in participant data.
Results: We defined stress according to parent accounts as an individual's subjective emotional experience and physiological response to a triggering object or event that the individual experiences or perceives as an imminent threat to personal wellbeing (including that of a child) or continued ability to function. Distinguishing causes from consequences of stress required careful analytic reference to delimited empirical cases. Diverse subtypes of stress were defined according to underlying causes; some common consequences, meanwhile, could be traced back to these subtypes. A typology of stress was thus constructed. We defined crisis to occur when stress (due to parenting, navigating, etc.) reaches a level that disrupts homeostasis of the affected parent-related functioning system (psychological self, physical self, family, or relationship) and results in either a sudden or progressive loss of function, and sometimes a sense that a catastrophic failure is imminent.
Conclusions: The definitions derived from this sub-analysis contribute coherence and family-centeredness to the concepts of stress and crisis because the parent is located as the central actor in defining and responding to stress in her situation. The typology of stress subtypes has strong fit with a substantial qualitative dataset, suggesting potential generalizability. These findings will be useful for increasing the relevance and specificity of future research into and measurement of stress among parents of children with autism. Findings will also be informative to professionals seeking to understand mechanisms and consequences of stress in such parents, as they vary over their long-term navigating process.

112 **179.112** Description and Outcomes of a Parent Education Package in the Context of a Comprehensive Applied Behavior Analysis Early Intervention Program

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Background: Â Young children with autism spectrum disorder (ASD) receive recommendations for a range of services, accessed through different service systems (e.g., insurance, schools). For parents, availability of education about how to obtain services is inconsistent. Following diagnosis, Applied Behavior Analysis (ABA) therapy is often recommended. In Washington State, wait times for ABA may exceed 1-2 years, often because families lack knowledge of how to navigate the service system. In effort to provide comprehensive early intervention services, and to potentially reduce wait times for ABA therapy, the ABA Early Intervention (ABA EI) Program at Seattle Children's Autism Center is a short-term (3 months), comprehensive, intensive treatment model that includes a parent education/support package. As part of this package, parents are taught how to access services, including accessing longer-term ABA therapy through insurance.
Objectives: Â The objective of this study is to highlight the parent education/support package included in the ABA EI Program, and to explore its effects on access to care following discharge, parent satisfaction, and parent stress and empowerment from baseline to post-treatment. Access to care findings for ABA EI patients are compared to a population of children with ASD served in an outpatient clinic in order to compare how many children accessed ABA therapy across groups.
Methods: Participants thus far include 43 children diagnosed with ASD, ages 18 months-9 years, and their parents. Children were selected from two groups: ABA EI Program participants (N = 23) or general outpatients (N = 20). To compare access to care across groups, an independent chart review was completed to determine if patients with referrals for ABA therapy were receiving it. Percent of children receiving ABA in each group was then calculated as the primary outcome measure. Additional secondary measures are being completed to evaluate changes in parent stress and empowerment from baseline to post-treatment (Parenting Stress Index; PSI; Abidin, 1995 and Family Empowerment Scale; FES; Koren, DeChillo & Friesen, 1992). The ABA EI Parent Satisfaction Survey is also being collected at post-treatment.
Results: Data collection is ongoing. Results from the primary outcome measure indicate that 61% (N = 23) of children in the ABA EI program successfully accessed ongoing ABA therapy, compared to 15% (N = 20) of outpatients. The mean ABA EI Satisfaction Survey score (N = 8) was 5 (SD = 0) on a scale of 1-5 (1 = unsatisfactory; 5 = very satisfactory). Results from other secondary measures (PSI and FES) have not yet been analyzed, as data collection is ongoing. Projected enrollment prior to presentation of results is 20-30 children.
Conclusions: Families receiving an intensive parent training/support package in the context of a brief early intervention program successfully accessed ongoing ABA therapy services at a much higher rate than children receiving less intensive outpatient services. Parents reported high satisfaction with the ABA EI program. These pilot findings suggest a focus on increased family support may be important for insuring families are able to navigate the complex service systems involved in caring for children with ASD.

113 **179.113** Development of a Standardized Protocol for Food Preference Assessment in Autism through Direct Observation.

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Background:
Food selectivity is a particular feature of the restrictions and stereotypes of Autism. The majority of studies have investigated food preferences and the factors influencing selectivity using caregiver or parent reports such as CEBI (Children's Eating Behavior Inventory), BAMBI (Brief Autism Mealtime Behavior Inventory), FPI (Food Preference Inventory) or YAQ (Youth/Adolescent Food Frequency Questionnaire, FFQ (Food Frequency Questionnaire) or others. All of these assessments document the presence of food selectivity in Autism subjects when comparing them to typically developing children. Thus far, no study in the literature proposes a standardized direct observation of feeding behavior protocol, which in principal should guarantee better accuracy; hence the purpose of our study.
Objectives:
In this pilot study, we assess the feasibility of a standardized protocol application to explore and monitor food selectivity by directly observing eating behavior in children and adolescents with autism residing at our Rehabilitation Institution.
Methods:
The study sample consisted of ten children and adolescents affected by Autism. The assessment of autism symptom severity was performed through the ADOS scale. Only patients with primary autism (with no cerebral damage or genetic diseases) were included in the final sample (subjects with ADOS Calibrated Severity Scale > 6). TenÂ subjects affected by mild-moderate intellectual disability not related to autism but residing at the Institution formed the control group. The caregivers present at each participant meal in the dining halls complied food diaries every day for lunch and dinner, carefully notating which foods the subjects accepted and which ones were refused. The observation period lasted four weeks with 20 days monitored (Monday to Friday of each week). The institution's general menu during this observation period consisted of 39 different serving selections at lunch and 37 at dinner. A comparison between the scores obtained from dietary choice patterns of the two groups and in particular the scores of refused foods was performed using a Mann-Whitney U test; the level of significance was set at $p < 0.05$. In autism group the Spearman non-parametric test was performed in order to explore correlations between the variables studied.
Results:
Subjects with autism resulted significantly more selective than controls (lunch: $p = 0.016$, dinner: $p = 0.042$). Furthermore, children and adolescents with autism were more at risk of becoming underweight or overweight because of unbalanced dietary intake. We found a negative correlation between: food selectivity and duration of stay ($R = - 0.5848$), as well as food selectivity and age ($R = - 0.6437$), but a positive correlation between food refusal and disease severity measured with ADOS II scale ($R = 0.4441$).
Conclusions:
Our data confirm the feasibility of a direct observation monitoring protocol for feeding behavior and the importance of food selectivity in subjects with autism. Younger children are more selective than older ones and the duration of institutional residency seems to positively impact this behavior.

114 **179.114** Do Aggressive Behaviors Accumulate or Exchange over Time?

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Background: Aggressive behaviors, directed either toward the self or others, can cause severe psychological and physical damage to individuals with autism, their family, or others. Prior research on other common behaviors seen in individuals with ASD, such as restricted and repetitive behaviors, has shown that there are fluctuations in their prevalence over time (Richler et al., 2010). Previous research from this lab has noted that individual aggressive behaviors vary in their age of emergence, with self-injurious behaviors typically starting first, followed by aggression toward individuals in the family, and later by aggression toward others. No study has yet looked at fluctuations in aggressive behavior to see if children acquire a repertoire of several of these behaviors over time or switch from one aggressive behavior to another.
Objectives: We hypothesized that children will acquire several behaviors as they age, starting with self-injurious behaviors, followed by aggression towards family, and ending with aggression towards others.
Methods: A sample of 168 children (79% male) aged 2-22 years (mean=7.6, SD=4.16) were included in the analysis. Diagnosis of ASD was confirmed by both the Autism Diagnostic Interview, Revised (ADI-R) and the Autism Diagnostic Observation Schedule (ADOS). The Behavior and Sensory Interest Questionnaire (BSIQ, Hanson et al, 2015) was administered to parents to understand the time of emergence and cessation of autism related behaviors, including aggression. Children who exhibited at least two different aggressive behaviors were included in the analysis. Descriptive statistics were used to determine the relationship between the age of emergence and age of cessation of different aggressive behaviors. Percentages were calculated to determine how many of the behaviors that emerged later emerged prior to cessation of earlier behaviors.
Results: Descriptive statistics reveal that 23.57% of later behaviors emerge at or after the cessation of the initial aggressive behavior. Additionally in a population of children that acquire two or more aggressive behaviors, the earliest form of aggression is typically aggression towards family members (onset of 3 years, 2 months on average), followed by aggression towards people outside of the family (3 years, 6 months on average) and finally self-injurious behavior (3 years, 10 months on average).
Conclusions: Results regarding accumulation of aggressive behaviors over time are consistent with the initial hypothesis. The low percentage of children that switch from behavior to behavior indicate that children with ASD more frequently tend to build a repertoire of different aggressive behaviors, rather than switching between them. Contrary to the initial hypothesis, aggression towards caregivers and aggression towards people outside of the family tend to emerge earlier than self-injurious behavior in a sample of ASD children that have at least two aggressive behaviors. These results highlight the importance of intervention for children with ASD who develop aggressive behaviors prior to them building a larger repertoire.

115 **179.115** Does Parent Training Have an Effect on Perceived Parenting Competence and Family Life Impairment? the Effects of Parent Training and Ongoing Education on PSOC and Flis Scores

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Background: The *Parenting Sense of Competence Scale* (PSOC; Gibaud-Wallston and Wandersman,1978), is a scale used to assess parent's perceived efficacy and satisfaction with their parenting roles. Gibaud-Wallston and Wanderman (1978) reported acceptable internal consistency of (Cronbach's alpha = .82). The *Family Life Impairment Scale*(FLIS; Briggs-Gowan, Horwitz, and Carter, 1997), is a parent-report scale used to assess how a child's behavior, personality, or special needs limits their engagement in activities that are common for families with young children. The FLIS has acceptable internal consistency (Cronbach's alpha = 0.81) (Carter et al., 2010). Studies suggest that reducing parental stress and improving their sense of competence provides immediate benefits and prevents behavior that leads to problems within the child and the family (Pisterman et al., 1992; Dawson & Osterling, 1997). Higher stress has been found in families with a child with autism spectrum disorders or with externalizing behaviors, compared to typically developed children (Bitsika & Sharpley, 2004). The goal of parent training and behavior therapy is to help parents gain specific skills that work with their child's behavior, and replace the therapist to generalize their child's skills and change behavior.
Objectives: This study aims to assess if parent trainings and ongoing parent education in therapy will have a significant impact on reported parental competency and reported family impairment.
Methods: The Pediatric Developmental Center treats children with developmental disorders. Families are either English- or Spanish-speaking and must complete a parent training before starting behavior therapy. Parents are also active participants in their child's behavior therapy. In this study, parents filled out the PSOC and FLIS at the first and last session of either an autism or behavior parent training. There were 203 parent-child dyads, children ranged in age from 2-17. A licensed therapist or a therapist in continuing graduate education led parent trainings once a week for 4 weeks and behavior therapy once a week for 12 or 16 weeks.
Results: Paired-samples t-test were run to examine any significant differences present in between pre- and post- tests for the PSOC and FLIS tests. Additional data will be run to compare these results with PSOC and FLIS scores after behavior therapy.
Conclusions: Can parent training improve family functioning? The current study aims to assess the impact of the parent training intervention on perceived parenting competence and family life impairment. Preliminary results show that there is no significant difference between pre- and post- tests for the PSOC and FLIS. This suggests that parent trainings alone may not be sufficient in improving parenting competence and family life impairment and that behavior therapy with parents as co-therapists is an essential component in creating a change (Schopler & Reichler,1971). Data is currently being collected after behavior therapy. It would be beneficial to measure for each parent at 3 time points: first and last day of the parent training program, and last day of the child's behavior therapy. Child's symptom severity would be beneficial information to assess change in maladaptive behaviors and their relationship with parental competency and family impairment.

116 **179.116** Effectiveness of the Military Spouse Online Autism Relocation Readiness Mentor Training Program

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Background:
Military families with children with autism spectrum disorder (ASD) experience challenges related to being a military family and challenges related to being a family who has a child with ASD; and during relocation, these challenges result in a build-up of stressors (Davis & Finke, 2015a). Qualitative studies of the experiences of military spouses with children with ASD found spouses reported delayed access to therapeutic services, limited providers accepting their insurance, a lack of IEP continuity, emotional and behavioral reactions from their children with ASD, and increased stress as a result of relocating (Davis & Finke, 2015a; Davis et al., 2016; Freuler & Baranek & Baranek, 2016). Some of these difficulties have been echoed in government reports (e.g., Ohio State University Project Team, 2011) and in interviews with military family support personnel (Aronson et al., 2016). Military spouses with children with ASD have stated relocations remove them from the community they have established and leave them feeling isolated (Davis & Finke, 2015a; Freuler & Baranek & Baranek, 2016). One support that may be an effective way to meet support needs of military families with children with ASD is distance peer mentoring. In distance peer mentoring, the mentor has characteristics similar to the mentee and provides emotional, affirmational, and informational support through technology-mediated communication (Dennis, 2003). Other parent groups have reported benefits from participating in distance peer support groups. For example, reviews of online social support groups for parents summarized benefits such as sharing personal experiences, receiving empathy and encouragement, and sharing feelings (Doty & Dworkin, 2014; Niela-Vilen, Axelin, Salantera, & Melender, 2014). Further, other parents of children with ASD have reported benefits of online social support such as encouragement, sharing resources and experiences, and having a connection with others who are similar (Huws, Jones, & Ingledew, 2001).
Objectives:
The main objective of this investigation was to examine the effectiveness of the military spouse online autism relocation readiness mentor training program on military spouse knowledge of training content.
Methods:
A quasi-experimental design, specifically a non-equivalent group pretest-posttest, was used to determine the effect of an online mentor training program on comprehension of program materials. Pretest-posttest quasi-experimental designs are frequently used to evaluate training programs (Bernard, 2013) and are very common designs in the social sciences (Trochim, 2006). However, determining an appropriate research design requires balancing experimental rigor with the purpose of the research and logistical constraints. Since limited research exists for military families regarding peer mentor training, a quasi-experimental design was appropriate to investigate possible outcomes while conserving resources often required for experimental studies.
Results:
Approximately 29 military spouses participated in either the training or control group for the online mentorship training program. Data analysis is currently on-going, but preliminary results suggest the online training was effective at teaching military spouses with children with autism mentoring protocols and strategies.
Conclusions:
Data analysis is currently on-going, but conclusions may impact clinical service providers, military programming and providers, and laws and policies.

117 **179.117** Effects of Parent Training Program for Caregivers of Young Children with Autism Spectrum Disorders (ASD)

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Background: Many parents of children with Autism Spectrum Disorders (ASD) are more likely to experience depression and stress than those of children with/without other types of disabilities. It could become much more pronounced when their children are diagnosed. Therefore, an appropriate program should be provided to reduce the parent's anxiety and parenting stress at a crucial time.
Objectives: The purpose of this study was to examine the effectiveness of a parent training program for caregivers of young children with ASD.
Methods: Fifteen parents participated in a series of lectures and group discussions for 5 months. Beck Depression Inventory-Second Edition (BDI-Ⅱ) and Parenting Stress Index (PSI) were used to measure the parent's anxiety and parenting stress. Knowledge of Behavioral Principle as Applied to Children (KBPAC) was used for a treatment fidelity check. These 3 measures were given at pre- and post-program, and at 3-month follow up. At the end of the program, the participants completed a questionnaire on degree of understanding and satisfaction with the program.
Results: BDI-Ⅱ scores of the participants significantly decreased at the end of the program and were maintained to 3 months. Similarly, PSI scores tended to decline although it was not a statistically significant change. KBPAC scores significantly increased from the beginning of the program, and the improved scores were maintained to 3 months. Most participants developed a better understanding of parenting skills and had a high level of satisfaction with the program.
Conclusions: The results revealed that the program could be effective for reducing the depression of caregivers of young children with ASD. However, the program was not effective enough to reduce parenting stress. A likely explanation is that the caregivers reacknowledged the problems that their children have shown and their responsibility as parents through the program. The program needs to be revised, focusing on reducing parenting stress more effectively. Starting at an early stage of awareness and diagnosis, the parent training program could play an important role as one of the early family intervention programs for ASD.

118 **179.118** Effects of a Psychoeducational Group on Siblings of Children with ASD

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Background: Available research on how having a sibling with autism spectrum disorder impacts typically developing children is mixed. Some studies show beneficial effects in the areas of social competence and self-concept and several studies show no additional risk or benefit. There also are many studies that indicate increased risk for adjustment difficulties and diminished quality of sibling relationships. While available research provides no clear answers with regards to impact of autism spectrum disorder on unaffected siblings, it is likely that there are some siblings who may be at risk just as there may be some who are not negatively impacted.
Objectives: Identify whether a psychoeducational group impacts sibling knowledge of ASD, sibling relationship quality, sibling interaction quality, and parent reported internalizing and externalizing symptoms.
Methods: Twenty-six children, their siblings with autism spectrum disorder, and their parents were participants in this study. All target children participated in two hour, weekly sessions over a period of seven weeks. The program (Siblings Helping Siblings) was partially based on a Sibshop model. Session content included recreational games and crafts, as well as discussions about having a sibling with autism spectrum disorder. Lessons were presented during each class that addressed characteristics of autism spectrum disorder, coping skills, and problem solving skills. Outcome variables were measured at preintervention, postintervention, and 8-10 weeks following intervention. Sibling relationship quality was measured through parent and child report and emotional adjustment was measured through parent report only. Sibling interaction quality was assessed through videotaped observations of dyadic interactions between the target sibling and the sibling with autism spectrum disorder.
Results: Analysis of variance was used to analyze obtained data. Sibling knowledge of ASD increased following intervention. Results indicated that parent perceptions of sibling relationship quality improved following intervention and increases in positive sibling interaction during unstructured playtime were also found postintervention. Exploratory analyses also suggested positive effects on target siblings' knowledge of autism spectrum disorder as well as reduction in parent-reported internalizing symptoms in the target children. Results also suggested that response to this intervention program may be impacted to some degree by the sex and diagnostic status of the target child.
Conclusions: These findings imply that there was a significant positive impact on target children after participating in this program. These results paired with high rates of parent and child satisfaction indicate this type of program could be an asset to clinics and schools that serve families affected by autism spectrum disorder. Such programs help service providers meet the needs of not only the child affected with autism spectrum disorder, but also meet the needs of their siblings and potentially other family members. Practitioners who wish to implement such a program should be aware that factors such as sex and disability status of participating children may affect how they respond to the program and adjustments should be considered to ensure the greatest benefit to those participating children. Furthermore, the implications of this study also suggest further research be conducted to further explore variables impacting the effectiveness of such programs.

119 **179.119** Engaging Under-Resourced Parents of Children with ASD in Service Uptake: Using Qualitative Research to Inform Interventions

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Background: Ethnically diverse children of low socioeconomic status and from non-English speaking households may receive an ASD diagnosis up to two years later than their white counterparts (Mandell et al., 2009; Valicenti-McDermott et al., 2012). Parent engagement interventions effectively support timely service access. Yet many interventions are developed and tested with White, high-resourced families and may not translate in practice with under-resourced communities. Gathering input from under-resourced communities during intervention development can help address these gaps in ASD diagnosis and treatment.
Objectives: Gather qualitative data from under-resourced families and their service providers for the purposes of identifying barriers, supports, and needs in seeking an ASD diagnosis and services. Utilize these data to inform a new intervention, designed to facilitate parent engagement in autism-specific services in under-resourced populations.
Methods: 19 Focus groups and 17 interviews were conducted in urban and rural neighborhoods of Philadelphia, Rochester, Los Angeles, and Sacramento with 105 parents and 125 providers. Caregivers had a child (2-8 years old) within 3 years of an ASD diagnosis, and received supplemental governmental assistance. Providers worked with families that met the above criteria.
Participants answered questions about barriers and facilitators to accessing evaluations and autism-specific services. We solicited recommendations for an intervention to address these issues in under-resourced families. Data were analyzed using open coding and then thematic analysis. Cross-site coding ensured interrater reliability and consensus across sites.
Results: Major themes that emerged included: (1) the contribution of cultural differences (including language, SES, and rurality); (2) systemic/family barriers (e.g., long waitlists, cultural stigma) to diagnostic and service disparities; and (3) supports, including agencies, practices and people (e.g., family members).
Recommendations included: (1) a parent "coach" immediately following diagnosis to help the family navigate the service system; (2) multiple methods of contacting caregivers (e.g., texting, online resources, outreach at community events); (3) flexible scheduling for parent workshops; (4) caregiver education on ASD; and (5) improving communication between professionals and families.
Conclusions: Â Results demonstrate consistency across sites, despite varying systems at state and district levels. This consistency exhibits the widespread need for a parent engagement intervention that supports under-resourced families in service uptake.
Findings will be used to develop a community-informed intervention that will be tested via RCT (N = 120) with caregivers of newly-diagnosed children from under-resourced backgrounds. Participants will be randomly assigned to either (1) a culturally matched peer parent coaching condition (including online and group trainings), (2) parent coaching condition with added provider consultation plus trainings, (3) a control condition of access to information only. Results from the RCT will be available in 2019 and will fill gaps in current evidence-based treatments that are not traditionally culturally sensitive, easily accessible, or tested with diverse populations. Continuing our community partnership will also increase the recruitment of underserved families in intervention studies.

120 **179.120** Enrollment in Early Intervention Associated with Increased Parental Stress in a Large Cohort of Parents of Young Children at Risk for Autism Spectrum Disorder

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Background: Efforts to identify and treat developmental delay in young children require strengthening caregiver capacity to support their child's needs. While an explicit goal of Birth to Three Early Intervention (EI) services is parent support, there is little data on the impact of such services on parental stress.
Objectives: To determine if low income, urban families involved in EI services experience lower levels of parental stress than those not engaged in EI services.
Methods: We analyzed cross-sectional data from 150 parents/guardians of children ages 15-27 months with confirmed autism risk at the time of enrollment in a large trial. Families were recruited from urban pediatric clinics in Boston, Philadelphia, and New Haven.Â We compared baseline levels of self-reported parenting stress (Parenting Stress Index – Short Form (PSI-SF)), Social Support (MOS-SS), and Negative Feelings toward Parenting (FIQ) among families participating in EI and those not involved in EI. Regression analysis was used to assess relationship between EI enrollment and measures of parental stress, while adjusting for prematurity (gestational age <37 weeks) and severity of child's delays using the Adaptive Behavior Assessment System (ABAS).
Results: In this sample of low-income, minority families, 46.7% were receiving EI services. Family demographics and severity of child delays were similar across groups. Parents of children enrolled in EI reported increased stress across multiple measures. We observed significant differences in Social Support (MOS-SS) and Negative Feelings toward Parenting (FIQ), and a trend toward differences in parenting stress (PSI-SF) (adjusted mean difference, p-value; -0.38, 0.02; 1.66, 0.04; 7.45, 0.08 respectively).
Conclusions: Parents participating in EI services reported lower levels of social support and higher levels of stress and self-blame than parents whose children were not receiving such services, even after adjusting for autism severity. A possible explanation is that new demands related to obtaining developmental services and the acknowledgement that a child has significant delays may place additional burden on caregivers.

121 **179.121** Evaluating the Social Validity of PEERS® for Young Adults, Teens, and Preschoolers in a Clinical Replication

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Background:
PEERS® is an empirically supported, parent-assisted social skills group for teens. Employing a comprehensive curriculum, the program builds skills through instruction, role-playing, modeling, and practice with feedback. PEERS® research suggests positive and durable effects on the social skills of teens with ASD and related disabilities (Laugeson et al., 2012). Currently, researchers are evaluating PEERS® curricula for young adults and preschoolers.
Few studies are devoted to evaluating the social validity (SV) of research-demonstrated autism interventions such as PEERS®. However, stakeholder approval is paramount when considering intervention diffusion and refinement. Indeed, stakeholders are more likely to select interventions they deem acceptable, while discontinuing those viewed as too demanding or inappropriate (Kazdin, 2000). Capitalizing on the burgeoning PEERS® evidence-base, research must pivot to empirical questions regarding stakeholder experiences.
Objectives:
Informing the development of our PEERS® clinical replication, we are surveying parent and patient participants across four SV domains: *acceptability*, *feasibility*, *perceived effectiveness*, and *satisfaction*.
Methods:
We are collecting clinical replication data of PEERS® at a university-based clinic. We have gathered data from 24 stakeholders involved in one teen, one young adult, and one preschool group (n = 12 parents; n = 12 adolescent/ young adults) and aim to gather data from 56 more participants by May 2017. Our inclusion criteria were identical to those described in PEERS® research. Every group had one female patient and the majority had ASD. Groups were supervised by a certified PEERS clinician and licensed psychologist. Attrition was minimal (three drops after session one). We found adequate reliability of item assignment to SV subdomains. We distributed the social validity questionnaires on the final session (response rate = 92%). The questionnaire used a 5-point scale: *strongly agree* = 5 to *strongly disagree* = 1.
Results:
Overall satisfaction across the groups was 3.9, with relatively high levels of group enjoyment (4.0). Stakeholders were modestly accepting of the intervention (3.6) and found it feasible (3.8)—parents of young adults were more neutral, whereas parents of preschoolers were more positive. For young adults and teens, parents were more neutral than patients. The perceived effectiveness on patients approached neutral (3.4), particularly for young adult perceptions of change (3.16) and parent perceptions of teen change (3.1). Attendance was high (mean = 90%; range: 67-100%). Exploratory correlations suggest, at $p < .05$, that (a) perceived effectiveness on parent behavior was negatively correlated with feasibility (r = -0.62) and positively correlated with overall satisfaction (0.77), (b) perceived effectiveness on patient behavior was positively correlated with program acceptance (r = 0.54), and (c) attendance was correlated with overall satisfaction (r= 0.49). Open-ended responses included: "I enjoyed learning new social skills" (teen), "It got me into the city regularly and reminded me to attend social events" (young adult), and "Now [young adult] is thinking about joining groups where he had not at all before" (parent).
Conclusions:
Preliminary results suggest modestly positive SV of PEERS®. Understanding the SV of PEERS® could help stakeholders improve successful contact with intervention. Our results are promising and warrant more rigorous investigation.

122 **179.122** Examination of Current Needs for ASD Specific Services in Saudi Arabia

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Background: Saudi Arabia society consists of three main geographies: urban, rural and Badia, which is the desert, inhabited by people called Bedouin, where the healthcare, education and population decreases respectively. This indicates wide diversity with a high population of children and adolescents. This vast difference between the three regions may have a fundamental impact on the individuals with ASD and their families. As a result the services demands may differ as well.
Objectives: The current study aimed to gather data on current services and needs of families with ASD children. The research investigated a number of environmental variables such as family size (nuclear and extended), number of children in the family, number of the children with developmental disorder, number of the children with ASD, gender of the ASD child, the child' order in the family, family income, and the parents' demographic information.
Methods: Mixed methodology was used in this study. Qualitative methods represented as a focus group and quantitative methods as a survey. The methods was conducted in Riyadh/ Saudi Arabia targeting parents of ASD children. The stages of the study were twofold: first phase, parents of children with ASD were invited to take part in the focus group. The purpose of this qualitative method is to identify the parents' most essential needs. One focus groups was conducted. Number of needs and required services was collected. In the second phase, four mother of children with ASD and four mothers of children diagnosed with other developmental disorders, namely: ADHD (2 mothers), language delay 91 mother) and Bardley Bidel (1 mother) were approached and completed the survey.
Results: The current study showed a significant limitation of the current services available in the country. One of the most frequently used programmes was ABA, yet this was also very limited. Mothers indicated that more services and better understanding about the ASD is needed.
Conclusions: ASD is not well recognised in many countries. In Saudi Arabia, ASD is gaining more attention and studies are underway to examine the needs of the families.

123 **179.123** Experiences of Middle School Children with Autism Spectrum Disorders in Adapted Physical Education

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Background: School-age children with autism spectrum disorders (ASDs) are rarely asked to describe their experiences within the programs that they receive and are largely missing from the narrative of their own lives. Current literature on the experiences of children with autism spectrum disorder (ASD) has focused on special education classrooms, sensory perceptions, and minimally on general physical education class expereinces. However, no prior studies have addressed how school-age children with ASD perceive their APE experience.
Objectives: To understand how children with ASD's perceive their experiences in adapted physical education.
Methods: Data were collected from participants (n=10) through drawings, observations in their APE setting and interviews. Exploratory, linguistic, and conceptual comments were used to deconstruct the data, develop themes in individual cases, and then identify connections across cases.
Results: Themes that emerged from the participants were their positive experiences in APE, understanding of the importance of being physically active, sedentary behavior in their spare time, and desire for time in APE.
Conclusions: Learning the barriers and facilitators to any individual's participation in a positive behavior is important. Barriers and facilitators for these participants included internal (intrapersonal) and external (interpersonal and environmental) factors. It is important in all settings to better identify these factors for populations that, historically, have been thought of as incapable of sharing their experiences.This study focused on a small sample of children with ASD and explored their experiences in APE. Although this study's outcomes cannot be generalized to the ASD population as a whole, this study will helps to lay the groundwork for future studies with larger samples that, in turn, can help facilitate improved learning outcomes for individuals with ASD in the APE setting.

124 **179.124** Experiences of Parents and Providers of ASD Services in Underserved California Communities

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Background: Â Ethnically diverse children with autism spectrum disorder (ASD) receive services at a later age and receive a different complement of services than White children (Mandell, Listerus, Levy, & Pinto-Martin, 2002; Levy et al., 2003). In California, families of children with ASD with Medi-Cal or other public insurance are less likely to use services considered medically necessary compared to families whose children were covered by private insurance (Thomas et al. 2007). Additionally, minority groups receive fewer services and significantly lower expenditures from California Regional Centers than those from White families (Harrington & Kang, 2008). These data suggest that state policies and socio-economic contexts impact families' access to autism services. The present study utilizes data collected from focus groups in California to investigate barriers minority and low-resource families experience when accessing autism-specific services in the state.
Objectives: Â To identify barriers and challenges facing under-resourced California families as they seek an ASD diagnosis and/or services.
Methods: Eight focus groups (4 provider, 4 parent) and four interviews (3 parent, 1 provider) conducted statewide were analyzed (N=62). Participants were recruited across regions in Northern and Southern California. Parents were eligible to participate if they had a child recently diagnosed with ASD and if they received some form of government assistance. Special efforts were made to recruit parents who identified as a racial or ethnic minority. Providers were eligible if they worked with low-resource or minority families with children with ASD. Transcripts were coded for eight major codes(e.g., barriers, cultural differences, knowledge). Two raters coded each transcript using Dedoose, and 30% of transcripts were coded across focus group collection site to ensure reliability.
Results: Systemic issues and cultural stigma emerged as major barriers to access experienced by under-resourced families. A lack of available quality services and programs was most prominent. Participants reported a need for culturally sensitive, bilingual therapists. Families also expressed frustration over biased practices, such as providers refusing to go into certain homes and neighborhoods, and different services offered to families by education level. Another systemic problem was the funding for autism services and therapies through medical insurance. This introduced additional barriers for families that contributed to long delays in services, and increased financial burdens for families (e.g., insurance co-pays). Navigating the system was a major source of concern for families, including being overwhelmed with scheduling and intrusions to the home environment. Finally, cultural denial was prevalent in both parent and provider conversations about stigma associated with disability. Respondents referenced the absence of vocabulary to describe autism in their native language, as well as the influence of gender roles within the family unit.
Conclusions: These findings highlight several systemic barriers and challenges that low-resource, culturally diverse families face when accessing ASD-specific services in California. Policies and procedures within California that negatively impact these communities warrant further investigation in order to inform efforts to improve access to care.

125 **179.125** Experiences of Sex Education and Sexual Awareness in Young Adults with Autism Spectrum Disorder

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Background: The research investigated feelings towards sex education and sexual awareness in young adults with autism spectrum disorder (ASD)
Objectives: To compare scores on sexual awareness measures between individuals with ASD and typically developing individuals.
Methods: Data were generated from the Sexual Knowledge, Experiences, Feelings and Needs Questionnaire (McCabe, 1999), the Sexual Awareness Questionnaire (Snell, Fisher & Miller, 1991) and semi-structured interviews. Twenty typically developing and twenty ASD individuals took part. Feelings toward sex education did not differ between the groups, but the groups differed significantly on measures of sexual awareness.
Results: The ASD group reported negative experiences of sex education and issues of vulnerability, social anxiety, and confused sexuality were prominent features of the qualitative interviews.
Conclusions: Sex and relationship education is not sufficient to match the needs of people with ASD. More research is needed into how young people with ASD perceive their sexuality, and young people need a voice to express their concerns.

126 **179.126** Exploring How US High School Students with Autism Are Using Social Media

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Background: While the primary focus of educators is on increasing academic achievement, high school students with autism are also concerned with the social aspects of their school days such as, entering peer groups, making friends, and developing intimate relationships. These non-academic skills may go unaddressed or overlooked by school staff. Within the social environment of high school, difficulties in the areas of communication and social interaction can put students with autism at risk for social isolation and bullying. For some individuals with autism, adolescence brings a growing self-awareness of social difficulties, and negative experiences with peers which may exacerbate social anxiety. Positive peer relationships have been found to facilitate positive social and academic outcomes. Social media, so commonly used by the majority of teens to navigate the social world, has been rarely examined in the lives of teens with autism.
Objectives: To understand what social media high school students with autism are using and what they perceive are its benefits and challenges.
Methods: Paper surveys were completed by 472 high school students with autism receiving special education services across 3 states in the US (California, North Carolina, Wisconsin) regarding their technology use both in and outside of school hours. Ten survey respondents were interviewed by email to probe more deeply into their perspectives of the benefits and challenges of technology.
Results: The majority of survey respondents (92%) reported using technology to communicate and to socialize. The most common tools they used included the phone (81%), text (69%), email (60%), Facebook (47%), and video calls (41%). Roughly 60% of survey respondents are active on social media using a variety of tools in addition to Facebook such as Instagram, Snapchat, Twitter, Kik, Vine, Tumblr, Steam, Google+, WhatsApp, and a variety of interactive video games. Eighty-six participants indicated they had had a bad experience using social media (e.g. someone was not nice to them). Participant descriptions of these experiences did not always fit the definition of bullying. None of the students said they had stopped using social media because of these experiences and many explained how they handled it using coping techniques such as defriending or blocking an offender, reporting the incident to an adult, or simply ignoring it.
Findings from qualitative email interviews revealed themes related to ways in which technology and social media can facilitate social opportunities. One common theme was bridging distance by providing contact when unable to physically visit someone due to inability to drive, or when the person is located far away. Other themes included providing a variety of options that easily facilitate social interactions from sharing photos using services such as Snapchat or Instagram, messaging friends while playing games online or watching gamers on YouTube channels and sharing comments with other viewers.
Conclusions: Our study showed that many adolescents with autism are using a wide variety of social media to increase their social interactions. This study has implications on how families and educators consider adolescents' access to and use of social media to support social skill development.

127 **179.127** Exploring Perceptions and Experiences of Autism in a UK Somali Community: A Qualitative Study

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Background: Evidence suggests that autism may be over-represented in some migrant groups in Western countries, including Somalis. Whilst reasons for a higher prevalence of autism in these groups are unclear, it is acknowledged that immigrant populations require appropriate help and support in relation to autism services. The Somali community is the second largest migrant community in Bristol, UK but little is known about the needs of families raising children with autism and the culture specific aspects of seeking help from health, or education and social care services. Such information is essential in order to provide high quality services and reduce inequalities in care for this group.
Objectives: The aim of this qualitative study was to address this gap in knowledge, to gain a better understanding of the perceptions, and experiences of autism within the Somali community, as well as their support needs.
Methods: Using a community-based participatory research approach, the research was conducted in partnership with the local Somali community. Through purposive sampling, Somali parents who had a child with autism were recruited. Fifteen parents participated (12 mothers and 3 fathers), who between them had 17 children with a diagnosis of autism. Two co-researchers conducted in-depth interviews, in both English and Somali, guided by a semi-structured interview schedule. With consent interviews were audio recorded and fully transcribed. Thematic Analysis was used to analyse the data.
Results:
Four major themes were identified through analysis;
1) 'My child is different' covers the parents' experiences of realising that their child was different to other children, their challenging behaviours and the impact on family life. It includes their hopes and fears for their children's future.
2) 'Perceptions of Autism' highlights why many Somali families have difficulty accepting their child's diagnosis, or engaging with services. As there is no Somali word for autism, parents struggle to communicate with, and often face conflicting messages from their community. Consequently children with autism are often hidden and families become isolated. Faith plays a crucial role in the process of acceptance.
3) 'Navigating the System'; Parents often struggle to get help for their child because the health, social and education services are unfamiliar, fragmented and difficult to navigate. Language barriers exacerbate these challenges. At the point of diagnosis many parents wanted better explanations and information about autism. Participants expressed mistrust of social services and confusion about the best form of educational provision.
4) Support; whilst some parents valued the support of specific professionals and organisations, other identified support needs for themselves and their children. In particular peer support was valued and a need to increase understanding about autism within the community was identified.
Conclusions: Â The findings highlight the importance of culture specific issues in autism and the challenges and barriers that Somali parents encounter in understanding and accepting autism and accessing appropriate support. They indicate the need to increase understanding via range of community channels in order to raise awareness, reduce stigma and provide support to encourage families not to delay seeking help for their children.

128 **179.128** Exploring the Components of Stress Responses in Parents of Children with and without ASD

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Background: Parenting stress is a complex process that includes external parenting demands, parent-child relationship quality, as well as the emotional and social well-being of parent and child. Parents of children with Autism Spectrum Disorder (ASD) report the highest levels of stress, above and beyond parents of children with typical development and Developmental Disabilities (Carter & Davis, 2008). Previous research focuses primarily on understanding the predictors of parenting stress (e.g. child problem behavior), yet few investigate the various components of stress (e.g. stress related to perceptions of parenting role, physiological markers).
Objectives: Primary aims include the examination of group differences in 5 facets of parent stress. We predict parents of children with ASD will demonstrate higher levels across all measures.
Methods: Participants included 37 mothers (mean age = 39.24 years, 4.94 years SD) of children ages 7 to 12 years (64% male) with and without an ASD diagnosis. While wearing a heart rate monitor, mothers watched a neutral 3-minute baseline video. Self-report measures included 3 subscales (Parental Distress, Parent Child Dysfunctional Interaction, Difficult Child) from the Parenting Stress Index Short Form (PSI-SF; Abidin, 1990) to assess the components of parenting stress, Perceived Stress Responsivity Scale (PSRS; Schlotz, Yim, Zoccola, Jansen, & Schulz, 2011) to assess perceived responses to daily stressful situations, and baseline RMSSD to assess vagally mediated heart rate variability indexing flexible emotional responding to stress.
Results: Due to multiple post-hoc comparisons, ANOVA was utilized with Bonferroni correction. Results revealed significantly higher perceived stress related to parent child interactions reported by parents of children with versus without ASD (p = .007*).* Group differences in the remaining components of stress were not significant at the p = .01 level.
Conclusions: This study adds insight to the literature on increased stress in parents of children with ASD. We sought to identify differences in specific components of stress between parents of children with and without ASD as potential areas of focus for future treatment targets. Results reveal no differences in perceived stress reactivity, HRV, as well as stress related to the parenting role or mother's perception of child difficulty. The only significant difference in stress involved the extent to which the mother perceived interactions with her child to be unsatisfying. This finding demonstrates an important factor to identify and target in parent-mediated treatments. Approaches that address parental stress, such as mindfulness based treatments, may be especially useful for targeting negative perceptions of child expectations during parent-child interactions and help lead to more satisfying mother-child experiences.

129 **179.129** Factors Associated with Participation in Extracurricular Activities in Adolescents with and without Asd from an Australian Representative Cohort.

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Background: According to the International Classification of Functioning Disability and Health (WHO, 2001), participation in social activities is a key determinant of functioning. Participating in social activities during adolescence is considered important for adult functioning. There is some evidence that individuals with autism spectrum disorder (ASD) participate less in social activities compared to their typically developing peers (TD). However, few studies have investigated what factors contribute to reduced participation. Understanding these factors will guide interventions for individuals with ASD and their families to enhance their functioning during adolescence and into adulthood.
Objectives: The objectives of this study were to: (1) compare the number of weekly activities that 14-15 year old adolescents with and without ASD participate in; (2) investigate factors associated with participation such as level of parental education, socio-economic status (SES), parent mental health, language spoken at home and family structure.
Methods: This study used data collected from the Kindergarten cohort of the Longitudinal Study of Australian Children (LSAC), a longitudinal study following up a representative sample of 10,000 Australian children every two years. The data set used for this study comprised 3,360 14-15 year olds without ASD and 94 with parent-reported ASD. These groups were compared based on the number of extracurricular activities they participated in (e.g., going to the cinema, swimming pool, sporting event, religious activity, library, concert, museum or another community event). We also investigated associations between participation and parent-reported characteristics of the family including the level of parental education, SES, parental mental health (depression), being from a family where English is the second language, being from a single parent family.
Results: Adolescents with TD did not differ from those with ASD in the number of extracurricular activities they participated in on a weekly basis (M_{TD}= 1.17, sd $_{TD}$= 1.07; M_{ASD} = 0.89, sd $_{ASD}$= 1.07; p = 0.198). Parents of adolescents with ASD were more likely to have had an episode of depression compared to TD peers (odds ratio= .53; 95% Conf. Interval = .34 - .85). Adjusted regression analyses showed lower participation in adolescents was associated with lower family SES (β= 0.001; p < .001), single parent family (β = 0.16; p = .001), English as a second language (β = 0.29; p<.001), lower parent education level (β = 0.33; p< .001) and the parent having had a major depressive episode during the last year (β= 0.10; p = .01).
Conclusions: Parental mental health, specifically having had depression during the last year, but not the young person's autism status, was associated with adolescents' participation in extracurricular activities. The assessment and treatment of parental depression should therefore be considered as part of a family centred approach when developing a support plan to enhance participation in adolescents with ASD.

130 **179.130** Factors Impacting Parental Belief of an Autism Spectrum Disorder Diagnosis Pre-Evaluation

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Background:
Â Parental recognition of child symptoms is one of the first levels of the help-seeking process (Goldberg & Huxley, 2003). Studies have shown parents recognize signs of autism much earlier than it is diagnosed (American Psychiatric Association & American Psychiatric Association, 1994). Once symptom recognition leads to seeking services, little is known about parents personal anticipation or belief of their child's autism spectrum disorder (ASD) status before an evaluation is made by the clinician to rule ASD in or out. Identification of the factors associated with parent's pre-evaluation beliefs and their relationship with the final clinical diagnosis can enhance clinicians' ability to contextualize results of diagnostic evaluations and promote parent acceptance of diagnosis and referral guidance.
Objectives:
Assess factors affecting parent belief aboutÂ anticipated child diagnosisÂ prior to ASD evaluation and subsequent factors influencing receiving an ASD diagnosis.
Methods:
Participants included 1035 parents whose children were evaluated at a university-based ASD specialty clinic. Mean child age was 7.12 years (range =0.5-18.5; 18.5% female). Parents completed intake and Background and History Questionnaire prior to their child's evaluation during the period from June 2014 to August 2016. Through this intake process, they answered a question about "whether they believe their child has ASD despite clinician diagnosis" and completed the Child Behavior Checklist (CBCL; Achenbach, 1991). Children were then evaluated by a multidisciplinary team to rule in or out an ASD diagnosis using DSM – IV criteria. 909 children (69.76%) had a confirmed ASD diagnosis (ASD group), while in 394 (30.24%), ASD was ruled out (non-ASD group). Adjusted odds ratios (aOR) were obtained using multivariate logistic regression to predict factors associated with agreement between parents' pre-evaluation belief that their child had ASD and ASD clinical diagnosis.
Results:
Pre-evaluation rate of parents believing their child had ASD was high (81%). Parental belief (aOR=1.68, p=0.007), above all factors, was positively associated with clinician diagnosis. Child age (6-9yrs:aOR=2.07, p= 0.001; 10-13yrs:aOR=2.13, p=0.006; >14yrs:aOR=3.34, p=0.01), behavior (aOR=2.22, p<0.001) and previous ASD diagnosis (aOR=1.95, p=0.001) were significantly positively associated with pre-evaluation parent belief of ASD. However, having an older child (6-9yrs:aOR=0.47, p<0.001; 10-13yrs:aOR=0.40, p<0.001; >14yrs:aOR=0.45, p=0.001) and more behavior problems (per CBCL; aOR=0.65, p<0.001) was associated with lower odds and a previous ASD diagnosis (aOR=5.78, p<0.001) was with higher odds of receiving a clinical diagnosis. Highest parent-clinician agreement was seen in kids >6yrs and those with low behavior problems (%agreement=72%)
Conclusions:
As this sample was seeking clinical services, parent belief status is skewed toward belief that the child has ASD. Half of the sample was below 6 years. Those over the age of 6 are more likely to be attending a structured educational setting providing opportunities for parents to receive more targeted feedback regarding their child from educators. This feedback along with parental observation of same-age peers may influence parents to consider ASD as an explanation for longstanding developmental concerns. Lower diagnosis rate in the older children and those with more behavioral issues might be reflective of other etiologies with behavioral phenotypes similar to ASD and need differential diagnosis.

131 **179.131** Factors That Drive Access to Services for Children with Neurodevelopmental Disorders in Low Income Populations

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Background: Â Children with Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD) from low-income households are identified later and receive fewer services than children from high-income households. This 'double whammy' in diagnosis and treatment means that, throughout their lives, children from low-income populations receive less intervention than children from middle- and high-income populations (Liptak et al., 2008; Thomas et al., 2007). Disparity in access to medical and non-medical services may result from internal and external factors. To address disparities in low-income, and ethnically and racially diverse ASD and ADHD populations, researchers must understand the factors linked to the presence of services.
Objectives: Â Identify factors related to services that children with neurodevelopmental disorders receive in school and private settings.Â Researchers hypothesized: (1) Elevated scores on BRIEF Global Executive Composite (GEC) and CBCL Problems will positively correlate with the presence of both medication and non-medication services. (2) Families of children without services will report more strain and less competence and self-efficacy.
Methods: Participants included 96 children ages 8-11 (M=9.67, SD=.83) from Title I schools (M=$100,727.23, SD=$83,853.08). Participants were referred to a school-based treatment study with a likely diagnosis of ADHD or ASD. Participants were analyzed by service type: (1) Children receiving non-medication services in school and private settings, N=45, (2) Children receiving both medication services and non-medication services, N=24, and (3) Children not receiving any services, N=27. Children only receiving medication were excluded from analyses. Parents completed self-report measures of caregiver strain, family empowerment, and child service programs.
Results: Findings indicate children's impairments in executive functioning and behavior significantly differ among service type, F(3, 95)=9.429, p<.001. Specifically, children receiving both medication and non-medication services were associated with the highest levels of executive dysfunction and problem behaviors; their families experience significantly greater strain. Children without services show less executive dysfunction and problem behaviors, while their families report less strain. When child behavioral measures were removed from the model, the significance of parental strain in relation to receiving both services persisted (r=.225, p=.040). Families of children without services did not report elevated strain (r=-.216, p=.030). However, absence of services was negatively related to parental self-efficacy (r=-.225, p=.039). When controlling for child behaviors, parental competence was strongly correlated with parental self-efficacy (r=.476, p<.001).
Conclusions: As anticipated, children with greater executive functioning needs and problem behaviors received both medication and non-medication services. Unexpectedly, families of children receiving both services experienced more strain than those who were not receiving services. This finding held true even when child behavioral characteristics were factored out of the relationship. Finally, independent of level of child functioning, parents report low self-efficacy in the absence of services. When parents are not confident in their ability to help their children and do not perceive child difficulties as family strain, children do not receive intervention. This further contributes to disparity in services within the present population. To better understand the relationships that predict services for low-income children with neurodevelopmental disorders, future studies should explore causal relationships that mediate access to services among diverse populations.

132 **179.132** Family Daily Hassles and School Variables in Typically-Developing Siblings of Children with Autism Spectrum Disorder

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Background: As Autism Spectrum Disorders (ASD) increase in prevalence, the number of typically-developing (TD) siblings of children with ASD has also increased. Sibling relationships have the potential to be the longest-lasting relationship of one's life. In addition to fulfilling traditional sibling roles, such as friend, protector, or confidante, siblings of children with ASD may take on additional unique roles (e.g., social model, caregiver; Celiberti & Harris, 1993; Bass & Mulick, 2007; Castorina & Negri, 2011). Thus, it is worth investigating the experiences of these TD siblings. While previous literature indicates mixed findings, recent studies with more rigorous methodologies have found that TD siblings of children with ASD fare as well as children without siblings with ASD (Dempsey, Llorens, Brewton, Muchandani, & Goin-Kochel, 2011; Shivers, Deisenroth, & Taylor, 2013; Hastings & Petalas, 2014).
Objectives: Little to no research has explored the academic functioning of TD siblings. We hypothesized that disruptions to families' daily routines (i.e., daily hassles) may have negatively impacted TD siblings' classroom behaviors and grades.
Methods: The *Parenting Daily Hassles Scale* (PDHQ; Crnic & Greenberg, 1990; Crnic & Booth, 1991) was collected as part of a larger battery from 39 parents.Â All parent participants (92% Caucasian, 90% married, 79% college-educated) had a child with an ASD diagnosis (80% male, *M* age = 11.74) and a TD child (62% male, *M* age = 10.31 years). Teachers (*n* = 25) reported on classroom functioning and parents provided report cards.
Results: Seventy-two percent of TD siblings (*n* = 18) had scores above the mean on the Academic Performance Rating Scale (APRS; DuPaul, Rapport, & Perriello, 1991), and 91% (*n* = 32) had grade averages of B or higher. Ninety-six percent (*n* = 24) of TD siblings had scores within the normative range on the Learning Problems and School Problems scales of the Behavior Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004). The Challenging Behaviors subscale of the PDHQ was not significantly correlated with any school variables for TD siblings. However, correlations with APRS score and report card grades were moderate in effect size; these relationships may have been significant with a larger sample size. The Parenting Tasks subscale was also not significantly correlated with any school measure.
Conclusions: One trend in our data suggests that parents who are distressed by their children's collective problem behaviors might have TD children with better academic performance and grades (perhaps due to coping). Small effect sizes in the relationships between the Parenting Tasks subscale and school variables suggest a minimal relationship between stress about parenting duties and TD childrens' academic functioning. Overall, most TD siblings performed well in the classroom and on their report card. This finding fits well with previous literature that most TD siblings of children with developmental disorders have generally positive outcomes (Sanders & Morgan, 1997; Grant, Ramcharan, & Flynn, 2007).

133 **179.133** Family Needs and Related Factors for Parents of Children with Autism Spectrum Disorder during Transition to Middle School

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Background: Parents of children with autism spectrum disorder (ASD) often face many difficulties and challenges in parenting. During transition to middle school, children with ASD are particularly at risk because their deficits in social interaction and communication make adaptation to new environment or new relationships difficult. These children need support from adults, however, their parents, being uncertain about the future of their children and unsure how to help them, also need assistance. In recent years, researchers and practitioners begin to pay more attention to caregiver issues.
Objectives: (1) understand the challenges, needs, and resources of Taiwanese parents of children with ASD during transition to middle school; (2) investigate the relationships among parenting efficacy, mental health, and social support of parents of children with high-functioning ASD (HFASD); and (3) explore the experience of mothers of children with HFASD to understand their views of the parent-teacher interaction and the difficulties in their children's school adjustment.
Methods: Â Both quantitative and qualitative methods were used. First, from the year 2010 database of the Special Needs Education Longitudinal Study (SNELS), 280 parents of six-grade children with autism or Asperger's disorder were selected. Their responses to those items related to family needs during transition to middle school in the SNELS parent questionnaire were analyzed. Secondly, 52 parents of school-aged children with HFASD from northern Taiwan completed a parenting efficacy scale, adult mental health scale, and social support scale. Finally, five mothers participated in a focus group and three of them also received individual interviews. Video and audio recordings from the focus group and individual interviews were verbatim transcribed. The narrative inquiry method was used for data processing.
Results: (1) During transition, the top four family needs were: professional information/service (93.2%), interpersonal support (75.4%), transitional placement (51.4%), and financial aid (27.5%). For children in special classes, their parents reported higher needs for professional information/service and transitional placement. For children with school adjustment difficulties, their parents reported higher needs for interpersonal support. (2) Parents showed an average degree of overall parenting efficacy (PE), mental health (MH), and social support (SS). PE positively correlated with MH and with SS, particularly emotional SS. MH only correlated positively with emotional SS. Both MH and SS demonstrated predictive power for PE, particularly positive mentality, anxiety, and emotional social support. (3) In their school experience, mothers acted as the voice for their children, the bridge between their children and teachers, and the helper to teachers. Mothers felt rejected, unaccepted, and misunderstood when interacting with teachers, particularly self-righteous teachers. Mothers expected teachers to be open, willing to listen and accept, understanding, helpful, and provide learning opportunities to their children; and schools to provide more special education resource and enhance the collaborations among resources and with teachers.
Conclusions: It is suggested that schools provide parent education, support groups, and counseling to help parents develop positive thinking and stress management skills to increase parenting efficacy and to empower parents. Future studies could examine the potential influences of other correlates on parenting efficacy.

134 **179.134** Family Perceptions of Community Autism Spectrum Disorder Stigma: Measure Validation and Ecological Associations

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Background: Though studies have documented the experience of stigma among family members of individuals with autism spectrum disorder (ASD), there are no standard scales of perceived community ASD stigma, and no measurement of how ASD stigma varies according to child, family, and health system factors.
Objectives: To develop a parent-reported scale of community ASD stigma. To assess child, family, and health system associations with community ASD stigma.
Methods: A random sample of Latino and non-Latino white parents of children with ASD seen at specialty clinics in California, Colorado, and Oregon in 2014-2015 (n=370; response rate 76.2%) were surveyed about experiences with ASD stigma and barriers to ASD diagnosis. The mixed-mode survey was performed in English or Spanish, and ASD diagnosis was verified via medical record review. Confirmatory factor analysis was used to create a scale of perceived community ASD stigma. Bivariate and multivariable analyses then compared associations of child, family, and health system characteristics with community ASD stigma.
Results: Confirmatory factor analysis results supported a single factor solution with 8 of 11 possible survey items best reflecting community ASD stigma. These eight items demonstrated good internal consistency (α=0.80). Nested regression model results suggested that child characteristics associated with greater community ASD stigma included having public health insurance and experiencing moderate or severe ASD. Family characteristics associated with greater ASD community stigma included having more children with ASD per household, having lived outside the U.S., and having a family structure that was divorced, separated, or widowed. Experiencing a greater number of barriers to ASD care was associated with greater community ASD stigma.
Conclusions: Factors at several ecological layers may influence perception of stigma among parents of children with ASD. These results may be notable to those attempting to reduce stigma about ASD as the identified child, family, and health system factors could be target points for future campaigns.

135 **179.135** Family Quality of Life: Impact of Parent Understanding and Perceptions of Autism Spectrum Disorder.

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Background:
Unlike many developmental disabilities (e.g., Down syndrome, fragile x syndrome) autism spectrum disorder (ASD) does not have a known universal genetic underpinning. As a result, parents may be less likely to have a firm understanding of the roots of their child's strengths and challenges. In fact, studies show that a genetic diagnosis gives validation and credibility to their child's needs (Makela et al., 2009), and family quality of life (QOL) is directly impacted by feelings of uncertainty (McStay, Trembath, & Dissanayake, 2014). It is well documented that compared to families with typically developing children and children with other neurodevelopmental disorders, families of children with ASD are less satisfied with their QOL (Gardiner & Iarocci, 2015). Bayat (2005) found that families that perceived positive effects of autism (e.g., family cohesion), most strongly predicted QOL. However, there is a paucity of literature exploring how autism severity influences the relationship between parent understanding of their child's disability and family QOL. The present study aims to explore this relationship.
Objectives:
The purpose of the present study is to examine QOL of families waitlisted for a parent-coaching intervention shortly after receiving an initial diagnosis. Specifically, family QOL will be explored as a function of parent perceptions of autism severity (measured by the impact of autism symptoms on everyday life via the *Autism Impact Measure*), and whether this relationship was moderated by parent understanding of their child's disability-related needs and strengths.
Methods:
30 families (n = 15 collected; n = 15 enrolled by March 2017) of children with ASD enrolled in early intervention were asked to complete questionnaires about family QOL and the impact of autism on their family's everyday life, among other measures in a larger research battery. Four items from the *ECO Family Outcomes Survey* (Bailey et al., 2011), were summed together as a measure of parent understanding of their child's strengths, abilities, delays, and/or needs. Two subscales of the *Family Quality of Life Survey* (Hoffman, Marquis, Poston, Summers, & Turnbull, 2006) were included to assess factors related to family interactions and parenting. Families also completed the *Autism Impact Measure* (Kanne, et al., 2014), to measure parent perceptions of the impact of their child's autism symptoms. Measures of child development and social functioning were also collected.
Results:
Based on existing literature, we hypothesize that parent understanding will be a contributing factor to family QOL, in addition to autism severity (i.e., impact on everyday functioning). Exploratory analyses will be used to determine how parent perceptions of autism symptoms predict family QOL and how this relationship is influenced by parent understanding of their child's disability-related needs and strengths.
Conclusions:
Results from the present study will highlight the importance of considering parent understanding of their child's disability on QOL. Findings will also emphasize the importance of educating families about ASD as a part of the intervention in order to potentially facilitate greater family QOL. Future directions include examining this relationship post-intervention as well as further exploring differences among families from varying ethnic and socioeconomic backgrounds.

136 **179.136** How Do We Study Autism As Neurodiversity?: A Review of Theoretical Perspectives, Empirical Findings, and Implications for Future Research

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Background: Neurodiversity is quickly becoming a household word, with the publication and dissemination of *NeuroTribes* (Silberman, 2015). Despite some theoretical examination, this concept has received little empirical evaluation.
Objectives: The purpose of the present study was to review the literature on neurodiversity with three primary aims:

1. Explore definitions of neurodiversity and emerging themes
2. Review empirical studies of neurodiversity and consider future research directions
3. Consider implications for viewing autism as neurodiversity (i.e., a culture, minority; Baker, 2006; Jaarsma & Welin, 2012; Lim, 2015)Â

Methods: A review of the term "neurodiversity" was conducted by searching PsycInfo and Web of Science. Only journal articles were included. Ten journal articles were uncovered in PsycInfo (*n* = 10), and forty-eight in Web of Science (*n* = 48), with 6 duplicates (*n* = 6). Articles were included if they discussed the theory of neurodiversity or were a direct empirical study of neurodiversity. Eighteen articles were further excluded for: not English language (*n* = 5), not specifically ASD (*n* = 6), not specifically about neurodiversity (*n* = 3), a response to another writing (*n* = 4). A total of thirty-five articles were then reviewed (*N* = 35). The first and second author independently reviewed half of the articles for themes and empirical findings. Theoretical themes were then discussed and finalized jointly.
Results: Theoretical papers (*n* = 26) broadly highlighted these common themes: application to a topic or field, the idea of autism from a medical vs. social perspective, autism as natural genetic variation, and the rights, advocacy, and justice issues surrounding autism and neurodiversity. Empirical papers (*n*= 9) sought to evaluate neurodiversity in these ways: teaching/pedagogy for neurodiverse individuals, terminology in describing autism, culture and neurodiversity, review of career interests, and visuospatial creativity as neurodiversity.
Conclusions: Themes of neurodiversity included applications, the medical vs. social model, natural variation, and rights, advocacy, and justice. While some empirical work has been conducted surrounding this concept, a great deal more research is needed to further examine the implications of conceptualizing neurodiversity as a minority or culture. Future directions of this work may include the following questions: What are methods for measuring neurodiversity – how is autism a genetic variant of typical functioning? What are the implications of dividing autism by high- and low-functioning – those who are neurodiverse and those who are neurodisabled? If autism is a culture, how then do current practices represent ethnocentrism in attempting to "change" people with autism to "make them fit" into majority culture? Can minority theories be applied to better understand the experience of neurodiverse people?

137 **179.137** Maternal Emotion Socialization and Child Problem Behaviours in an Autism Spectrum Disorder Population: The Role of the Broad Autism Phenotype and Distress

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Background: Many children with autism spectrum disorder (ASD) exhibit problem behaviours that interfere with everyday activities. As problem behaviours are so prevalent and impactful, it is important to gain a broader understanding of the possible factors that may increase problem behaviours, as well as buffer against the development of problem behaviours. Emotion socialization has been linked to problem behaviours in typically developing children; however, the association between maternal emotion socialization and child problem behaviours in children with ASD has yet to be sufficiently examined. Furthermore, there is strong evidence to support the notion that mothers of children with ASD experience high levels of distress (stress, anxiety, and depression). In typically developing populations, maternal distress has been associated with parenting behaviours, such as emotion socialization, and problem behaviours in children. On average, approximately 16 to 23% of mothers of children with ASD demonstrate characteristics of the broad autism phenotype (BAP; e.g., Bishop et al., 2004; Sasson et al., 2013; Wheelwright et al., 2010), which includes mild deficits in social interaction and pragmatic language. As these deficits affect basic social communication, it is important to understand whether mothers who demonstrate characteristics of the BAP differ from those without these characteristics during efforts to socialize emotion with their children.
Objectives: The purpose of the current study was to explore emotion socialization practices (emotion coaching, supportive reactions, unsupportive reactions, positive expressiveness, and negative expressiveness) and the outcome of child problem behaviours, while taking into account maternal characteristics of the BAP and distress (stress, anxiety, depression, and parenting stress).
Methods: Participants included 57 mothers of children age 6 to 16 years diagnosed with high functioning ASD. Mother's completed a series of questionnaires relating to emotion socialization, distress, characteristics of the BAP, and child problem behaviours.
Results: Mothers were separated into groups: without BAP status group and with BAP status group. Multiple regression and moderation analyses were conducted. The results revealed that emotion socialization practices alone did not predict child problem behaviours. However, with the inclusion of distress as a moderator, the relation between emotion socialization and problem behaviours revealed differences between the BAP groups. That is, in mothers without BAP status, when predicting child problem behaviours, stress moderated emotion coaching, supportive reactions, and positive expressiveness. Anxiety and parenting stress also moderated emotion coaching. In mothers with BAP status, stress and parenting stress moderated the relation between negative expressiveness and child problem behaviours.
Conclusions: The current study highlighted the importance of considering maternal characteristics, such as distress and BAP status, when examining maternal emotion socialization practices and child outcomes within an ASD population. The current study also provides preliminary evidence for the usefulness of the emotion socialization framework within an ASD population, which has implications for both researchers and professionals working with this population.

138 **179.138** Maternal Poor Sleep of Children with ASD in Saudia Arabia and UK

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Background: Sleep problems in children are common, with around one third of children experiencing some kind of sleep disturbance during their development. Many children with ASD are reported to have severe sleep problems including long night time wakings and sleep onset delay. This is particularly important as sleep plays an active role in children's memory consolidation and impacts daytime functioning.
Objectives: To date, most research has primarily focused on sleep characteristics of children with ASD in western countries. Very little research used objective assessments of sleep parameters and mental health of mothers who have school-age children with ASD. The current study was twofold: 1) examine maternal sleep and mental health (depression and anxiety) and 2) examine if there are *ethnic differences in sleep by comparison two groups: UK and Saudi Arabia.*
Saudi Arabia is a country with very little research carried out on children with ASD and their families. Yet, numbers of diagnosis are on increase as well as awareness. Hence gaining understanding of common sleep issues and maternal mental health status is of great importance.
Methods: Participants included 90 mothers of children with ASD (50% from UK) and 90 mothers in control group (no ASD, 50% from UK). Inclusion criteria were that all children had to be of school age and have current diagnosis of ASD. Maternal sleep was measured using actigraphy for 7 days and further assessed using a large battery of Sleep Questionnaires such as The Pittsburgh Sleep Quality Index and sleep diary. Maternal mental status was measured using Becks Inventory and Parenting Stress Index. Each mother filled in Childhood Sleep and Habits Questionnaire about their child's sleep patterns.
Results: As expected children with ASD had significantly higher sleep onset delay and decreased sleep, large number of night-time wakings in comparison to the control group. Mothers in both groups suffered from sleep onset delay, frequent night wakings and shorter sleep. In sum their sleep quality and quantity significantly differed from the control group. Interestingly, sleep parameters of mothers in Saudi Arabia were significantly worse than both groups. On the depression and stress index mothers from the UK group had higher scores than the Saudi group. Regression models showed that depression and poor sleep were strongly associated with the child's sleep.
Conclusions: The findings confirm previous studies that children with ASD suffer from sleep problems. New findings using objective sleep measures show that maternal sleep is linked to their child' sleep patterns. The association of sleep to depression and anxietyÂ scores ought to be examined further and treatments should be offered to manage sleep issues of mothers and their children as a unit. More proactive work needs to be put towards the ASD awareness in the Middle East countries.

139 **179.139** Maternal Sleep Problems and Depression of Children with ASD

W. A. Bin Eid[1] *and D. Dimitriou*[2]*, (1)Lifespan Learning and Sleep Lab, Institute of Education UCL, London, United Kingdom, (2)UCL, Institute of Education, London, England, United Kingdom*

Background: Sleep problems in children are common, with around one third of children experiencing some kind of sleep disturbance during their development. Many children with ASD are reported to have severe sleep problems including long night time wakings and sleep onset delay. This is particularly important as sleep plays an active role in children's memory consolidation and impacts daytime functioning.
Objectives: To date, most research has primarily focused on sleep characteristics of children with ASD in western countries. Very little research used objective assessments of sleep parameters and mental health of mothers who have school-age children with ASD. The current study was twofold: 1) examine maternal sleep and mental health (depression and anxiety) and 2) examine if there are *ethnic differences in sleep by comparison two groups: UK and Saudi Arabia.*
Saudi Arabia is a country with very little research carried out on children with ASD and their families. Yet, numbers of diagnosis are on increase as well as awareness. Hence gaining understanding of common sleep issues and maternal mental health status is of great importance.
Methods: Participants included 90 mothers of children with ASD (50% from UK) and 90 mothers in control group (no ASD, 50% from UK). Inclusion criteria were that all children had to be of school age and have current diagnosis of ASD. Maternal sleep was measured using actigraphy for 7 days and further assessed using a large battery of Sleep Questionnaires such as The Pittsburgh Sleep Quality Index and sleep diary. Maternal mental status was measured using Becks Inventory and Parenting Stress Index. Each mother filled in Childhood Sleep and Habits Questionnaire about their child's sleep patterns.
Results: As expected children with ASD had significantly higher sleep onset delay and decreased sleep, large number of night-time wakings in comparison to the control group. Mothers in both groups suffered from sleep onset delay, frequent night wakings and shorter sleep. In sum their sleep quality and quantity significantly differed from the control group. Interestingly, sleep parameters of mothers in Saudi Arabia were significantly worse than both groups. On the depression and stress index mothers from the UK group had higher scores than the Saudi group. Regression models showed that depression and poor sleep were strongly associated with the child's sleep.
Conclusions: The findings confirm previous studies that children with ASD suffer from sleep problems. New findings using objective sleep measures show that maternal sleep is linked to their child' sleep patterns. The association of sleep to depression and anxietyÂ scores ought to be examined further and treatments should be offered to manage sleep issues of mothers and their children as a unit. More proactive work needs to be put towards the ASD awareness in the Middle East countries.

140 **179.140** Measures of Treatment Fidelity and Social Validity within a Parent-Mediated Behavior Intervention

A. D. Rodgers[1]*, L. A. Ruble*[1]*, G. M. Kuravackel*[2]*, A. P. Ables*[3] *and R. J. Reese*[4]*, (1)University of Kentucky, Lexington, KY, (2)University of Louisville, Louisville, KY, (3)University of Louisville Autism Center, University of Louisville, Louisville, KY, (4)Educational, School and Counseling Psychology, University of Kentucky, Lexington, KY*

Background: An effective intervention not only results in good outcomes, but has quality features of treatment fidelity (the accuracy and consistency of implementation of an intervention) and social validity (participants' impressions of the importance and acceptability of the intervention, including satisfaction and therapeutic alliance, cf. Ardito & Rabellino, 2011. We examined these constructs within a quasi-experimental study of an 8-week parent training and therapeutic support program for children with ASD and problem behavior called COMPASS for Hope (C-HOPE). Despite the fact that individuals with ASD manifest higher levels of challenging behaviors and that parents are the first-line interventionists (Matson, Wilkins, & Macken, 2009), little parent training group-design research is available targeting these problem behaviors. Moreover, of the extant studies, few measured parent outcomes, none measured multiple parent outcome indicators – parent stress and parent competency – and few measured fidelity and social validity. Given the potential for parent training and support to decrease child problem behavior, increase parent competency, and decrease parent stress, an understanding of factors such as fidelity and social validity is critical for future dissemination.
Objectives: The purpose of this study was to examine (a) therapist treatment fidelity; (b) parent satisfaction; (c) parent outcomes; and (d) therapeutic alliance within C-HOPE. The larger study included both face-to-face (FF) and telehealth (TH) delivery formats, thus, a secondary objective was to determine whether differences exist between delivery methods.
Methods: The larger study employed a pre-post waitlist control design in a sample (N=33) of parents of children with ASD (M_{age}=8.1, SD_{age}=2.5). Participants received C-HOPE delivered via TH (N=20) or FF (N=13). Fidelity was measured using a checklist of essential session components. Satisfaction was measured using a 4-point Likert scale of session characteristics. Parent outcomes were measured using the Outcome Rating Scale (ORS; Miller & Duncan, 2000), which is divided into subscales of Individual, Interpersonal, Social, and Overall outcomes. Therapeutic alliance was measured using the Session Rating Scale (SRS; Johnson, Miller, & Duncan, 2000) and the Group Session Rating Scale (GSRS; Duncan & Miller, 2007), which are divided into subscales of Relationship, Goals/Topics, Approach/Method, and Overall. All ORS, SRS, and GSRS ratings are made using a 10-cm line visual analog scale.
Results: Therapist treatment adherence ranged from 76.2% to 100.0% (*M*=94.2, *SD*=7.1), and parent-reported satisfaction with sessions was high (*M*=3.7, *SD*=0.3). Parent outcome scores improved significantly from the first session (*M*=24.8, *SD*=8.8) to the eighth session (*M*=30.8, *SD*=8.5), t(17)=-3.71, p=0.002. Alliance was high with regard to parent-therapist relationship (*M*=9.3, *SD*=0.7), goals/topics (*M*=9.3, *SD*=0.8), approach/method (*M*=9.4, *SD*=0.6), and overall (*M*=9.2, *SD*=0.8). One-way analysis of variance revealed no differences between FF and TH modalities in the areas measured.
Conclusions: Social validity for C-HOPE is high, and can be implemented with fidelity across cohorts and modalities. Additionally, C-HOPE favorably impacted parents, who were both satisfied and demonstrated improvements individually, relationally, and socially. Future research is needed to assess how these factors impact final outcomes of child problem behavior, parent stress, and parent competency.

141 **179.141** Multi-Informant Assessment of Typically-Developing Sibling Psychological Functioning: Pitfalls of Single-Informant Assessment

J. A. Rankin[1]*, C. A. Paisley*[2]*, L. K. Baker*[2]*, T. Tomeny*[1] *and T. D. Barry*[3]*, (1)The University of Alabama, Tuscaloosa, AL, (2)University of Alabama, Tuscaloosa, AL, (3)Washington State University, Pullman, WA*

Background: Â Self- and parent-reports of typically-developing (TD) sibling psychological maladjustment often vary in their estimates of risk status (Meadan, Stoner, & Angell, 2010). This may be due, in part, to many TD sibling studies examining only one informant (Meadan et al., 2010). However, use of only one informant often leads a measure to demonstrate weaker specificity and sensitivity when determining risk status and an underestimation of actual risk (Goodman et al., 2000).Â Critically, theÂ correspondence of TD sibling "at-risk" status outcomes between parent and youth reports has yet to be examined. Furthermore, whether differences exist in the relation between different informant's reports and known predictors of TD sibling outcomes [e.g., externalizing behaviors associated with ASD, broader autism phenotype (BAP) symptoms; Petalas et al., 2012] has yet to be examined.
Objectives: Â N/A
Methods: Â Participants were 113 dyads, consisting of a parent and a TD sibling of a child with ASD. Parents completed the Strengths and Difficulties Questionnaire (SDQ), assessing emotional and behavioral functioning, and Children's Social Behavior Questionnaire (CSBQ), assessing BAP and ASD symptom severity, about the TD sibling (M_{age} = 13.33, 50% male) and about their child with ASD, respectively; the Symptom Checklist Revised10 (SCLR 10) and Questionnaire on Resources and Stress (QRSF) about themselves, measuring broad mental health and parenting stress, respectively. TD siblings self-reported via the SDQ and the Child and Adolescent Social Support Scale (CASSS), the latter measuring perceived social support.
Results: Â Suggested classification cutoffs on the SDQ (see Goodman, 1997) were used to classify each sibling into no-risk ('normal' classification) or at-risk ('borderline' and 'abnormal' classifications). Overall, 75% of reports yielded no risk on either parent or sibling report. In youth where risk was indicated, only 21% had risk indicated on *both* reports (see Table 1). Hierarchical Linear Modeling (HLM), with informants nested within siblings, examined differences between informants in the effects of predictors of psychological maladjustment (e.g., parental stress) on TD sibling functioning. Overall, the effects of parent mental health concerns (β_{11} = -.17, t = 2.33, p =.02), TD sibling BAP symptoms (β_{11} = -.27, t = 6.46, p < .001), ASD symptoms (β_{11} = -.09, t = 2.47, p =.02), and ASD externalizing symptoms (β_{11} = -.66, t = 2.25, p = .03) all varied in their relations with TD sibling SDQ depending on the informant. No differences based on informantÂ were found for either the effect of parental stress (β_{11} = -.36, t = 1.19, p =.23) or social support on SDQ (β_{11} = -.01, t = 1.06, p = .29).
Conclusions: Â Results suggest that parent and sibling reports may identify different TD youth to be at risk of psychological maladjustment. Thus, single-informant investigations of siblings may be understating actual rates of TD sibling risk status among families with a child with ASD. Furthermore, 4 of 6 factors previously related to TD sibling functioning varied in their effects depending on which informant was used, highlighting the need for investigations to include reports, and perspectives, of parents and the siblings themselves.

142 **179.142** Narratives about the Transition to Adulthood: Parent and Adolescent Differences in Visions of the Future

A. V. Kirby[1]*, S. Wright*[1]*, M. L. Diener*[2]*, C. Wright*[1] *and C. Taylor*[1]*, (1)University of Utah, Salt Lake City, UT, (2)Family & Consumer Studies, University of Utah, Salt Lake City, UT*

Background: Adolescence is a critical time in which families of adolescents with autism spectrum disorder (ASD) plan and prepare for the future. Recent evidence suggests that parental expectations in adolescence act as significant mediators of outcomes in adulthood (Kirby, 2016). However, little is known about alignment between parent and adolescent visions of the future and how their visions influence family decision-making during the transition to adulthood. Narrative approaches allow for in-depth exploration of both parent and adolescent visions of the future, which may help uncover challenges experienced by families and clarify ways for professionals to better meet families' needs.
Objectives: To examine and compare narratives about adulthood from adolescents with ASD and their parents
Methods: To address the study objective, we analyzed qualitative interviews from adolescents with ASD and their parents from two of our research studies. In the total combined sample, we collected qualitative interviews with 23 adolescents with ASD (ages 12-17; *M*=15.6; 2 females) and 21 parents. Adolescent inclusion criteria for the first study was parent-reported ability to participate in an open-ended interview and for the second, anticipated receipt of a high school diploma. In both studies, each adolescent and parent were interviewed separately and asked about their visions for the future related to the adolescent transitioning to adulthood. Interviews were semi-structured in nature, audio-recorded, transcribed verbatim, and are being analyzed using multiple coders. Trustworthiness was further enhanced by using an audit-trail, triangulation with quantitative data sources (i.e., questionnaire data on parental expectations), and use of thick and detailed descriptions in the final report (Brantlinger et al., 2005).
Results: Preliminary qualitative analysis suggests drastic differences in the narratives provided by each adolescent with ASD versus those provided by their parent. In general, adolescents provided more positive and ambitious visions of their adulthood while parents provided more cautious, constrained, and less-independent visions. Quantitative results used during the triangulation process confirm the limited expectations parents held about their children's futures. Specifically, according to parents on a 4- or 5-point scale (scale differed slightly between studies), fewer than half of the adolescents "definitely" would: live independently (17%), participate in social activities outside of work, school, or family functions (30%), get a paid job (48%), or be financially self-sufficient (17%). Complete analysis will be completed by May 2017.
Conclusions: The results of our analysis suggest that parents and adolescents have disparate views of the future which may restrict families' abilities to effectively plan and prepare for the future. These narratives add context to recent findings that suggest parental expectations are longitudinal predictors of adult outcomes. From a justice perspective, it is important to allow adolescents self-determination when it comes to planning for their future (Wehmeyer & Shogren, 2016) while also recognizing the critical role parents play in supporting and protecting their children during this tumultuous time. Clinical implications include the need for families to have open communication during adolescence and for professionals to support both parents and adolescents to set realistic goals in order to work toward shared visions of the future.

Poster Session
180 - International and Cross-Cultural Perspectives
12:00 PM - 1:40 PM - Golden Gate Ballroom

143 **180.143** 'reading the Mind in the Eyes' in Bengali Populations in India and England: Assaying Effects of Language and Culture

M. M. Halder[1] *and M. K. Belmonte*[2]*, (1)Nottingham Trent University, Nottingham, United Kingdom, (2)Com DEALL Trust, Bangalore, INDIA*

Background: Studies of social cognition and its disorders must accommodate local cultural norms if they are to be valid, but must be normed and referred to international standards of diagnosis and assessment if they are to be credible. There thus is a need for translation of standard instruments into local languages, and adaptation for local cultures. The 'Reading the Mind in the Eyes' Test (RMET) is a widely used instrument assessing social perception of complex affective and cognitive states from pictures of eyes, based on linguistic labelling of these states. Despite translations into many European and other languages worldwide, till recently no version of the RMET had been formulated for South Asia. A companion study by Dasgupta et al. has translated the adult RMET into bangla, the language of Bangladesh and the Indian state of West Bengal.
Objectives: To assess cross-cultural validity of the bangla RMET.
Methods: Data from the bangla RMET collected from 135 (70 female) adult native (first language) bangla speakers in Kolkata, India are contrasted to those from a matched sample of 60 native bangla speakers in Nottingham, England. Further samples of native English speakers in Kolkata and native English speakers of South Asian ethnicity in Nottingham, matched to these other samples for age, sex, education and socioeconomic status, are contrasted against these in a 2 x 2 (culture x language) analysis of variance, using both the full 36-item RMET and a version that omits the six items identified by Dasgupta et al. as not reaching criterion validity in the bangla translation.
Results: Preliminary results indicate an effect of language but no effect of culture, and no interaction, on 36-item scores but not on the 30-item shortened version. Data analysis is ongoing.
Conclusions: Despite its faults and confounds, the RMET has demonstrated value as a quick index of one aspect of social cognition. Disentangling effects of language and culture can be difficult, especially for a test such as the RMET that (1) relies so heavily on verbal encodings, and (2) depends on monoracially caucasian images with which most people in the world have little or no perceptual experience. Our preliminary results suggest that in the particular case of the RMET, language is a greater determinant than culture, but that comparability can be achieved by excluding a small set of linguistically problematic items. Future RMET versions should make use of ethnically diverse facial emotion models representative of worldwide populations.

144 **180.144** A Cross-Site Examination of Barriers to Diagnosis and Service Utilization for Autism Spectrum Disorder (ASD) Among Latino Families in California

F. A. Reinosa Segovia[1]*, J. Smith*[1]*, A. Aranbarri*[2] *and C. Kasari*[3]*, (1)University of California Los Angeles, Los Angeles, CA, (2)University of California, Davis. MIND Institute, Sacramento, CA, (3)University of California, Los Angeles, Los Angeles, CA*

Background: Â Several barriers have been associated with the challenges involved in obtaining effective early interventions for children with autism spectrum disorder (ASD). Several studies have found that race, ethnicity, and socioeconomic status have been associated with a delay in the diagnosis of ASD and access to services (Liptak et al., 2008; Mandell et al., 2005; Parish et al., 2012). Compared with white children with autism, Latino children are diagnosed at a later age and receive poorer quality of care (Mandell et al., 2009; Magaña et al., 2013; Magaña et al., 2016; Parish et al., 2012). Furthermore, few studies have thoroughly examined the cultural relevance of ASD interventions in order to meet the needs of Latino children with ASD.
Objectives: 1) To examine the experiences and barriers of Latino families seeking an ASD diagnosis and accessing services for their children. 2) Get parents' feedback and opinions to inform and develop a pilot intervention for under-resourced communities.
Methods: Participants were 12 Spanish speaking parents [m_{age} *(SD)*Â = 37.9 (5.2), n = 11 females] who participated in two focus groups and three interviews in two sites in California. Participants were recruited via direct referral from regional centers and non-profit organizations. All interviews and focus groups were led by a Spanish-speaker moderator, audio-recorded, and transcribed in Spanish. A senior member of the research team open-coded transcripts to develop a code book, and Spanish-language coders verified the relevance of these codes to the Spanish language transcripts. Inter-coder reliability reached 60% (Cohen's kappa) and remaining disagreements were resolved via consensus. Demographic data were also collected pertaining to the family's education and income, and the child's age of diagnosis and school placement.
Results: Three main themes emerged through analysis: 1) Logistic Barriers *("Nos traen como pelotita [rebotando]"*): Most parents reported bouncing back and forth between doctors, providers, and regional centers while seeking a diagnosis and services for their children. Parents also reported being redirected or rejected by service agencies due to lack of health insurance. 2) Cultural Differences (*"Buscando las palabras correctas en español"*): All parents commented about language difficulties when working with providers. Challenges included difficulties understanding Spanish translators as well as advocating and securing services for their children effectively. 3) Lack of Knowledge (*"No sé qué es"):* the majority of parents commented about their lack of knowledge related to the causes, signs, and treatments for ASD, wondering if the etiology of ASD could be attributed to a mental disorder andÂ remaining uncertain on how to navigate the process for service initiation.
Conclusions: The findings of this study suggest that Latino families faced different barriers in receiving a diagnostic and treatment services for their children with ASD. Specifically logistic factors, cultural differences, and lack of knowledge acted as prominent barriers that hindered Latino parents' attempts to access services. Future research should examine ways to address the identified obstacles, and tailor interventions to be culturally relevant for under-resourced Latino families who must navigate large, bureaucratic systems of care.

145 **180.145** Age of Initial Caregiver Concern and Diagnosis in Asian Children at a Regional Satellite Autism Clinic

***M. Lambha**, Marcus Autism Center, Atlanta, GA*

Background: Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication, interaction and restricted, repetitive patterns of behavior/interests (American Psychiatric Association, 2013). Studies have found that caregiver reports regarding initial age of developmental concerns in children occur between 12 and 24 months (Rogers & DiLalla, 1990; DeGiacomo and Fombonne, 1998). ASD diagnoses can be made as early as 24 months (Charman & Baird, 2002), allowing for earlier intervention, leading to improved outcomes (Dawson, Rogers, & Munson, 2010; Eapen, Crncec, & Walkter, 2013; Reichow, 2012). While prevalence rates of autism has increased and the age of diagnosis has decreased among US children, ethnic differences exist (CDC, 2014). Studies have begun to investigate ethnic differences in these areas, with some research finding that the age of initial caregiver concern and first diagnosis is older in Asians compared to other ethnicities (Daley, 2004; Mandell, et al, 2009).
Objectives: This study examined caregiver reports of age of initial concern with regard to their child's development and the age of first diagnosis in an Asian and clinical sample at a regional clinic. It was hypothesized that the age of first concerns and age of first diagnosis for the Asian sample would be significantly older than the clinical sample.
Methods: Data from a sample of 11 Asian children (ages 20 to 44 months) and the clinical sample of 119 children (ages 16 to 44) who were diagnosed with ASD at a regional clinic was used. Data from record review for the Asian sample included age (M=31.09 months), gender (male N = 10, female N = 1), and caregiver report of initial concern (M = 19.09). Similar data was obtained for the clinical sample: age (M = 29.78), gender (male N =99, female N = 20), and caregiver report of initial concern (M = 16.05). Data from the Asian sample were compared to the clinical sample children diagnosed with ASD at a regional clinic using an independent samples t-test.
Results: This sample of Asian children did not differ significantly from the clinical sample with regard to caregiver recognition of developmental concern (19 months and 16 months, respectively) or age of first diagnosis (31 months and 29 months, respectively). Further analyses will be conducted to examine possible relations between type of caregiver concern with age of first concern and age of first diagnosis.
Conclusions: These finding show that parents of Asian children and parents of the clinical sample of children at a regional clinic are reporting similar ages of initial concern. Additionally, these children are being diagnosed at a similar age. Although some studies have suggested that caregiver recognition of initial developmental concerns as well as age at first diagnosis are significantly older for Asian children, the results of this study are not showing these significant differences. These results are encouraging in that they suggest that Asian parents are recognizing concerns and having their children evaluated at an age similar to the clinical sample, allowing for earlier diagnosis and treatment of Asian children.

146 **180.146** Autism in a Korean American Evangelical Community

***P. S. Hong**[1], B. Leventhal[2], A. Sullivan[2], B. Kim[2] and Y. S. Kim[3], (1)Psychiatry, UCSF, San Francisco, CA, (2)UCSF, San Francisco, CA, (3)University of California San Francisco, San Francisco, CA*

Background: There are 1.7 million Korean-Americans in the United States. The majority of Korean-Americans, 71%, identify as Christian. Of Protestant Korean-Americans, 66% identify as evangelical Christian, the largest of any Asian or ethnic group in the United States. Korean-Americans underutilize mental health services, resulting in more severe diagnoses when and if services are eventually utilized. We sought to understand how cultural, spiritual, and religious processes might unfold and influence each other in shaping perceptions of autism spectrum disorder (ASD) in predominantly Korean-American church communities. While previous research has examined ASD in Korean speaking communities, little is known about perceptions toward ASD in predominantly Korean-American church communities where English is the primary spoken language (1.5 to 3rdgeneration).
Objectives: We wanted to generate themes in understanding the following: 1) explanations of ASD in spiritual communities that may encompass processes beyond material disease; 2) the immediate moral context in which the concrete experience of ASD plays out and is acknowledged, appropriated, and analyzed; 3) whether attitudes toward ASD differ from depression and, if so, in what ways and why; and 4) whether greater cultural assimilation may lead to differences in perceptions of ASD.
Methods: A mixed-methods approach was used combining participant observation, textual analysis, semi-structured interviews based on Arthur Kleinman's Explanatory Model, adapted Perceived Devaluation Discrimination Scale (PDDS), and narratives. The lead author conducted ethnographic work from May 2015 to May 2016 in a predominantly Korean-American, English-speaking, evangelical, nondenominational congregation. Twenty-eight attendees, including church leaders, children's ministry leaders, and members of varying commitment levels to the church were interviewed about their perceptions and/or experiences of ASD and/or mental illness. Analysis followed a deductive approach where data were categorized into themes based on existing theories around Kleinman's "What's At Stake" framework, based on how one finds meaning and is able to fully participate in a community. Emergent text from themes was generated using ATLAS.ti (qualitative analysis software), and relational themes were then merged.
Results: This exploratory study yielded numerous themes, indicating that social death is based on the degree to which people are able to achieve what matters most in the local context. A diagnosis of ASD was believed to negatively influence marriage prospects, career prospects, and close friendships. Salient spiritual explanations were held regarding depression, but not ASD, where spirituality was mentioned only in the context of finding support and meaning in a diagnosis. While understandings of symptoms varied, most understood ASD to be a genetic condition and did not feel it would stigmatize the entire family. Structural barriers to obtaining care were not cited. Semantic domains surrounding ASD differed from those found in previous studies in Korean-speaking groups.
Conclusions: Cultural, spiritual, and religious processes influence each other to produce experience of ASD. This study has created a framework by which to conduct research in churches as a step in effectively addressing unmet mental health needs, decreasing stigma, and encouraging the use of professional mental health services in Korean-Americans.

147 **180.147** Caregivers Needs of Persons with Autism Spectrum Disorders in Latin America: Results from Chile

R. A. Garcia[1], *M. Irarrazaval*[2], *S. Riesle*[3], *A. Moyano*[4], *M. Cabezas*[5], *A. Rattazzi*[6], *G. Garrido*[7], *C. S. Paula*[8], *C. Montiel-Nava*[9], *D. Valdez*[10], *A. Rosoli*[11], *S. H. Cukier*[6] *and F. Prieto*[12], *(1)Universidad de Chile, Santiago, CHILE, (2)University of Chile, Santiago, Santiago, Chile, (3)Independent, Santiago, CHILE, (4)Universidad de Chile, Santiago, Chile, (5)Clínica Las Condes, Santiago, Chile, (6)PANAACEA, Programa Argentino para Niños, Adolescentes y Adultos con Condiciones del Espectro Autista, Buenos Aires, Argentina, (7)Universidad de la República, Montevideo, URUGUAY, (8)Developmental Disorder Program, Mackenzie Presbyterian Univesrsity, Sao Paulo, BRAZIL, (9)La Universidad del Zulia, Gainesville, GA, (10)FLACSO, Buenos Aires, Argentina, (11)OEI, Santo Domingo, Dominican Republic, (12)Millenium Institute for Research in Depression and Personality, Santiago de Chile, Chile*

Background:
Research about autism spectrum disorders (ASD) and health and education services are limited. This study is part of a larger study based conducted in six Latin American countries (Argentina, Brazil, Chile, Uruguay, Panama, Dominican Republic) by the Red Espectro Autista Latinoamerica (REAL). Its purpose is to assess the needs of families with a member with ASD, in order to enhance awareness, improve services, and develop long-term policy solutions related to ASD.
Objectives:
Understand and analyze the major needs and challenges regarding access to health and educational services faced by families affected by ASD in REAL countries.
Methods:
Quantitative and qualitative description (n = 2965) study by online survey between Dec-2015 and April-2016, which assessed the needs of families affected by ASD.
Results:
292 Chilean families participated. The diagnosis most prevalent was ASD, being more common in men (8:1). There is a difference of 32 months between the age of early parental concerns ($\bar{x}$ = 28m) and age at diagnosis ($\bar{x}$ = 60m). The professionals more involved in the diagnosis are neurologists (45%) and psychiatrists (18%). There is limited access to health services, and few percent of subjects attend to Cognitive Behavioural Therapy (16%), Sensory Integration Therapy (13%), Ocupational Therapy (36%), Social Skills Therapy (22.3%) and Language Therapy (34.7%). Caregivers considered very important that the child has support for progress in school (83%) or make friends (75%), however 68% experience frustration in relation to their efforts to obtain services. 53% reported side economic problems because of ASD. Their priorities focus on ensuring adequate health services (23%) and education (29%).
Conclusions:
In Chile, there is a late diagnosis, along with low support and satisfaction in health and educational services delivery in children with ASD. These results provide scientific evidence for the development of strategies to improve the clinical and educational services available, and solutions that improve the quality of life of children with ASD and their families.

148 **180.148** Characteristics Associated with Drug Prescription and Compliance Among Children with Autism in South Israel.

G. Meiri[1,2], *H. Azoulay*[1] *and I. Menashe*[1], *(1)Ben-Gurion University of the Negev, Beersheva, Israel, (2)Pre-School Psychiatry Unit, Soroka University Medical Center, Beer-Sheva, Israel*

Background: Currently, there are no effective medical drugs to treat autism. Most medications that are given to people with autism are designed to treat other comorbidities (e.g. ADHD, epilepsy, insomnia, etc.). However, data regarding the prevalence of drug prescription and compliances to these medications in people with autism is limited
Objectives: To study the characteristics associated with medical drugs prescription and compliance among people with autism.
Methods: We studied the characteristics associated with medical drugs prescription and compliance in a population-based sample of children between ages 1-6 years who were diagnosed and followed at the Preschool Psychiatric Unit at the Soroka University Medical Center between the years 2006-2013. Autism diagnosis was determined using DSM-IV and re-confirmed using DSM-V criteria. Data about drug prescription and compliance was acquired from the electronic records of these patients. Drug compliance was calculated as the percentage of purchased drugs out of total prescriptions, and was divided into three categories: 0-49% - no compliance; 50-74% - partial compliance; and 75-100% full compliance.
Results: Of the 211 children in our sample, 50 (23.7%) received one prescription, 19 (9.0%) received two prescriptions, and six children (2.8%) received prescriptions to three or more drugs. The most prevalent prescription in our sample was to atypical antipsychotic drugs (49 children; 23.2%), followed by stimulants (28 children; 13.2%) and old generation antipsychotic drugs (16 children; 7.6%). Drug prescription was positively correlated with autism severity, and was associated with the ethnicity of the child and the type of comorbidities (P<0.001). Compliance to drug prescription was slightly higher among Bedouin than in Jewish children (P – 0.039), and was intriguingly low for stimulants (61%) compared to other drugs (P = 0.05). There was no association between drug compliance and autism severity in our sample.
Conclusions: Â Our preliminary finding suggest that prescription and compliance to medical drugs among children with autism are associated with various clinical and cultural characteristics which should be considered by physicians as part of the general treatment planning.

149 **180.149** Cross-Cultural Validation Study of Emotion-Based Social Skills Training for Children with Autism

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Background:
Emotion-based Social Skills Training (EBSST; Wong et al., 2010) is a manualized therapy program that enhances the emotion competence of children with Autism Spectrum Disorder (ASD), reduces symptoms of mental disorders, and develops emotion coaching skills for parents and educators (Ratcliffe, Wong et al., 2014). EBSST was developed and evaluated in an English-speaking, Australian school context. EBSST program fidelity and effectiveness in other language and cultural groups is yet to be explored. Lau (2006) outlines methods of cultural adaptation of mental health interventions and highlights that cultural sensitivity to the values, concepts and ideas around children, families, disability, and mental health needs to be applied. In the ASD literature, two cross-cultural adaptation studies have been described for manualized social skills interventions: PEERS (Laugeson & Frankel, 2010; Yoo et al., 2014) and KONTAKT (Herbrecht et al., 2007; Olsson et al., 2016). In this study the cultural adaptation of EBSST to Chinese settings was undertaken. This was a joint project between Transcultural Mental Health Centre, who provide mental health interventions to people from culturally and linguistically diverse communities and the Children's Hospital at Westmead, where the EBSST program was developed and researched.
Objectives:
The aims of this study were: (i) develop a protocol for the cultural and language adaptation of EBSST; (ii) evaluate the effectiveness, feasibility and acceptability of Emotion-based Social Skills Training being delivered by bilingual psychologists to children with Autism and their families from the Australian-Chinese community; and (iii) identify adjustments to English-language EBSST that need to be made to maintain fidelity of the EBSST program for children with Autism and their families from the Australian-Chinese community.
Methods:
A convergent mixed-method approach involving quantitative and qualitative evaluation was applied. Six children with ASD aged 8 to 12 years and their parents from the Australian-Chinese community were recruited. Eligibility assessments were conducted using the Autism Diagnostic Observation Schedule (Lord, 2000) and cultural assessments were conducted based on the DSM-5 cultural formulation approach (American Psychiatric Association, 2013). Bilingual psychologists were trained and certified as EBSST facilitators and delivered 16 group EBSST sessions to children. Six group EBSST sessions to parents were delivered in the Chinese language, with culturally appropriate adaptations. Quantitative data on child emotions development and child and parent mental health was collected pre- and post-treatment. Qualitative data on treatment acceptability and feasibility was collected from children, parents and psychologists from questionnaires and semi-structured interviews.
Results:
EBSST for Australian-Chinese families demonstrated improvements on quantitative measures of child emotions competence and child and parent mental health pre- and post-treatment. Children, parents and psychologists all rated the intervention as acceptable and feasible.
Conclusions:
Cultural and language adaptations are important to consider when developing and delivering therapeutic interventions to children with ASD and their families from different cultural groups. The findings of this study will inform an international research collaboration between Australia and China where a control group trial of EBSST in a school for 80 children with Autism in China will be undertaken.

150 **180.150** Cross-Cultural Views of Autism: How Latino and Anglo Parents Report Symptoms of ASD

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Background: Though ethnic and racial disparities have been reported in both diagnosis and treatment of mental health disorders, few studies have explored potential differences in how parents of varying cultural backgrounds perceive symptoms of autism spectrum disorder (ASD). Most have relied on hypotheses of socioeconomic and access barriers to explain findings, or cultural explanations for the less frequent reporting of symptoms and lower rates of ASD diagnosis among Latino children. Our 2014 published study of 83 families found that although Anglo mothers reported more developmental concerns, Latino children obtained higher severity scores on standardized measures of ASD.
Objectives: The current study was designed to extend our previous findings using a larger sample of Anglo and Latino families collected from a free screening clinic at the University of California, Riverside. We compared how mothers reported current concerns (22 autism-related questions) and ASD symptoms, in relation to their child's performance on standardized measures of ASD.
Methods: Â One-way ANOVAs were conducted (corrected for multiple comparisons where applicable).
Results: Using a sample of 181 families (n = 61 Anglo, n = 120 Latino), Anglo parents reported a significantly higher number of total current concerns compared to Latino parents $F(1,179) = 15.94$, $p < .000$. Using ADOS scores, children were sorted by categories of "non-spectrum", "autism spectrum" or "autism". No significant differences were observed in either ADOS domains for children who scored into the "autism spectrum" category. For children in the "autism" category (n = 25 Anglo, n = 28 Latino), Latino children scored significantly higher on both the social affect ($p < .000$) and restricted and repetitive behavior ($p = .002$) domains. Parent-reported levels of autism symptomology were available from 96 families (n = 49 Anglo, n = 47 Latino). Latino parents reported higher levels of autism symptoms versus Anglo parents for all five subscales (all ps < .029). Note that SRS measures were not scored until after the ADOS took place. Anglo and Latino families did not differ on reported level of income ($p > .1$). However, Anglo parents were significantly more likely to have received a Bachelor's Degree or higher compared to Latino parents ($p < .000$).
Conclusions: These data support the finding that Anglo and Latino parents differ in their perceptions of their children's symptomology.Â Latino parents reported more severe symptoms on the SRS in all domains, yet Anglo parents reported more current concerns during the interview. Finally, results from the ADOS suggest that Latino children who met ASD criteria scored significantly higher than Anglo children on both ADOS domains. Latino parents may not have been aware that the challenging behaviors or the lack of social awarenss thatÂ they observed in their child were related to ASD. Yet when asked directly about the frequency of behaviors (via the SRS), Latino parents reported more severe symptoms of ASD, consistent with examiners' observations on the ADOS.Â These findings provide evidence that regardless of SES, cultural context may affect how parents perceive autism symptoms, andÂ is an important consideration when interpreting parent-report measures.

151 **180.151** Developing a Global Framework for Improving the Lives of Individuals with Autism Spectrum Disorder

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Background: With the growing global prevalence of Autism Spectrum Disorder (ASD), international governments and community members have struggled to meet the increasing needs of individuals with this condition, and their families.
Objectives: Our goal was to identify challenges currently facing communities worldwide in meeting the needs of individuals with ASD, and offer policy recommendations that would support these individuals and their families.
Methods: During the winter and spring of 2016 we conducted 23 semi-structured telephone interviews with a convenience sample of clinicians, researchers, policymakers, and non-profit workers with knowledge regarding ASD services in their country, or internationally. Participants were from 12 countries, ranging from low and middle income to high-income countries worldwide. We asked participants questions related to the current level of services provided in their country, barriers faced in expanding these services, and established practices for overcoming these barriers, if available. Interview data were analyzed using thematic analysis. Research was sponsored by the Qatar Foundation's World Innovation Summit in Health (WISH).
Results: From our interviews, five main themes emerged related to challenges faced in meeting the growing needs of individuals with ASD worldwide: early identification and diagnosis, offering evidence-based therapies, providing family support systems, enabling access to public education, vocational training and assisted employment, and participating in high-quality research and surveillance. Opportunities to overcome these barriers utilized resources available in the health, educational and social sectors of countries. Based on these challenges and opportunities, we developed three overarching recommendations for policymakers worldwide to coordinate the response to ASD, and affect substantive change: (1) Create an interagency coordinating commission to address ASD nationally, (2) Establish interdisciplinary training and research centers for excellence in ASD, and (3) Establish a global partnership framework to address ASD across the lifespan.
Conclusions: The guidance developed from this work will help governments enact policies that improve the lives of individuals with ASD, their families and their communities.

152 **180.152** Differences in Parenting Stress Between Monolingual and Multilingual Parents of Children with Autism Spectrum Disorder (ASD) Participating in an Early Intervention Study

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Background:
As the U.S. immigrant population grows, it becomes pressing for researchers to develop culturally and linguistically responsive interventions to better address the needs of children with ASD and their families from diverse backgrounds. Studies have shown that multilingual parents are often discouraged from speaking their primary language to their children with ASD (Jegatheesan, 2011; Kremer-Sadlik, 2005; Wharton et al., 2000; Yu, 2013). In addition, multilingual parents, with or without high English proficiency, feel less effective in showing affection and expanding their children's language, thus precluding engaging interactions (Kremer-Sadlik, 2005; Wharton et al., 2000; Yu, 2009) and creating parenting stress (Jagatheesan, 2011; Yu, 2009; Yu, 2013). High parenting stress can have a detrimental influence on the effectiveness of intervention, negatively impacting children's outcome (Karst & Van Hecke, 2012). However, extant research on multilingual children with ASD and their families primarily focuses on child's language and social outcomes and rarely focuses on parental outcomes.
Objectives:
This study aims to evaluate stress reduction in monolingual (i.e. English as primary language) and multilingual parents across two treatment conditions, psychoeducational or caregiver-mediated, and to compare the group differences in stress reduction post treatment.
Methods:
Participants (n=86) were part of a larger research study comparing the effects of two parent-mediated interventions on joint attention outcomes of toddlers (22-36 months) with ASD. Parents reported their primary languages in a demographic questionnaire. Parenting Stress Index (PSI; Abdin, 1990) was used to assess parenting stress pre- and post-treatment. Two-way ANOVA was used to compare group differences in stress reduction between monolingual and multilingual parents across treatment groups.
Results:
65% of the participating caregivers were monolingual, with English as their only language, and 77.9% having a college or higher degree. Due to attrition and missing data, only 78 out of the original 86 participants were included (mean age=35.9); 78% of the participants that were not included are monolingual. Two-way ANOVA showed no statistically significant interaction between parents' language status and treatment assignment ($F_{1, 74}$= .995, ns).
Conclusions:
The results find no interaction between parents' language status and group treatment group on stress reduction. However, it is worth noting that majority of the parents participating this study are monolingual and having obtained a college or higher degree. Hence, this particular group of participants might have been at advantage in overcoming potential linguistic barriers, which could contribute to parenting stress, compared to lower-resourced families from culturally and linguistically diverse backgrounds. Future research should explore if accommodating parents' preferred language when developing parent education program and parent-mediated interventions directly reduces parenting stress.

153 **180.153** Effectiveness of Professional Development Training on Autism in Helping Professionals in Ethiopia: A Single Group, Pre-Post Design.

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Background:
Data is lacking in terms of how autism spectrum disorders (ASDs) are identified and managed in Africa, which is a pressing concern as autism prevalence has been increasing. Children with ASD in Africa are diagnosed later than children in other less impoverished areas of the world. This disparity may be related to sub-Saharan educators and helping professionals lacking awareness of ASD. The access to mental health services beyond the aforementioned sources is scarce, expensive, or inaccessible in Ethiopia. This lack of access to services results in limited attention for diagnostic processes, therapeutic interventions, and mistreatment of children. For example, a child in Ethiopia with a mental health diagnosis and challenges is likely to be rejected by public regular schools outright; because special education services are available only in few special schools, and few children have access to services (Tirusew, 2006). Additionally, regular public schools are encouraged, but not required by law, to accept children with disabilities (Zeleke, 2016). Further, most of the special schools are equipped only to provide education to children with visual and hearing impairments (Tirusew, 2006). These policies are a result of the lack of mental health training and limited educational backgrounds of the service providers and low levels of community awareness of mental health disorders. This highlights a need for drastic improvement in training of mental health disorders and interventions for health service professionals to provide adequate and appropriate services for the children they care for.
Objectives: Â The purpose of this study was to provide educators and health professionals (i.e. teachers, counselors, psychologists, therapists, therapeutic care workers, social workers, and nurses) with a basic understanding of Autism Spectrum Disorders over the course of ten in-service training days. Specifically we aim to examine the effectiveness of the training on participants' knowledge and understanding of the basic features of ASDs and evidence-based interventions associated with ASDs as well as how to tailor the interventions to fit cultural expectations.
Methods:
Using a single group, pre-post design, the level of awareness, knowledge, and understanding of ASDs treatment and intervention of 35 helping professionals who have been recruited for the professional development training by the host university, was measured. Data collection was the same for all participants. Once permissions were obtained, all participants completed a demographics questionnaire. All participants then received ten days of training about symptoms of and interventions for ASDs.
Results: Â Results identified significant positive changes in participants' awareness, knowledge, and understanding of evidence-based ASDs treatment and intervention..
Â Conclusions:
We believe that this study has important implications for the education of helping professionals about ASDs and culturally-competent, evidence-based interventions in Ethiopia. Because the program appears to be effective, we hope that with continuous professional development training over time, educators and healthcare professionals will be able to work more effectively in addressing the needs of children with ASDs in Ethiopia.

154 **180.154** Factor Analysis of the Parental Concerns Questionnaire in Children with Autism Spectrum Disorder

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Background:
The Parental Concerns Questionnaire (PCQ) a 13-itme interview-based rating scale designed to assess the presence and severity of developmental and behavioral concerns expr
disorder (ASD). The PCQ yields a single total score (13 to 52) that is reflective of overall symptom severity. Previous research has demonstrated the validity of PCQ in children wit
However, psychometrically-defined factors of the PCQ in children with ASD of non-English speaking parents have not yet been explored.
Objectives:
The purpose of this study was to adopt and examine the factor structure of the PCQ in children with ASD in Saudi Arabia.
Methods:
A total of 205 parents of children with ASD and were younger than 21 (M = 7.9; 3.5 SD) years responded to an online survey. An adapted version of the PCQ was used and factor
was utilized as the data were relatively normally distributed (*Costello & Osborne, 2005*) while the scree plot with the exclusion of the inflexion point's criterion was used to determir
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Results:
The 13 items scale appeared to underlie one factor with reliability above the acceptable limit (Cronbach's alpha = 0.80).
Â
Conclusions:

Table 1. Severity of the Autistic Symptoms Factor

Item: My child…	Fact
1- Language use and understanding (Doesn't use words, has difficulty initiating conversations).	
2- Compulsive behavior (Completes routines always in the same manner).	
3- Anxiety (Shows distress from new situations or crowds).	
4- Sensory issues (Reacts to lights, sounds, textures).	
5- Sleep disturbance (Does not fall asleep easily, wakes often).	
6- Aggression (Intentionally hits, bites others).	
7- Hyperactivity (Is constantly moving, jumping, and running).	
8- Attention span (Has difficulty finishing a task).	
9- Mood swings (Has unpredictable changes between emotions).	
10- Eating habits (Eats few foods/certain types of food).	
11- Mood swings (Prefers to be alone has few friends).	
12- Self-stimulatory behavior (Rocks, spins, flaps hands).	
13- Self-injurious behavior (Bangs head, pinches, bites, hits oneself).	

The Arabic version of the PCQ shows promise for assessing the overall symptom severity in children with ASD. Additional exploratory factor analyses may provide further support

155 **180.155** Family Empowerment and Caregiver Strain Among Ethnically Diverse Caregivers of Children with ASD or ADHD

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Background:
Caregivers of children with developmental disabilities experience significantly greater stress than parents of typically developing children (Baker et al., 2003). These challenges have been thought to be even greater for ethnic minority parents who face additional difficulties related to socioeconomic status, access to health care and information, and language barriers. However, in previous studies Latino parents have self-reported less family burden than Black and non-Latino White parents (Biel et al., 2015).
Objectives:
This study seeks to compare the extent to which diverse caregivers of children with ASD or ADHD feel strained by their children's difficulties, feel confident in their abilities as caregivers, and feel confident in their ability to use the mental health systems that impact their child.
Methods: Â
Participants in the current study were 103 parents of children diagnosed with ASD (n=33) or ADHD (n=70) who were participating in a larger study comparing two interventions for executive dysfunction. Participants were drawn from Title I eligible schools in the Washington, D.C. area, which resulted in an ethnically and socioeconomically diverse sample (Table 1). White caregivers reported significantly higher levels of income and education than Black and Latino caregivers.
Caregivers completed three self-report measures: the Caregiver Strain Questionnaire-Short Form 7 (CSQ-7) (Brannan et al., 2012), and the Competence and Self-Efficacy subscales of the Family Empowerment Scale (FES) (Singh et al., 1995). Each measure consisted of 5-point Likert scale items. Measures were offered in English and Spanish and presented in paper form or orally by study staff, depending on caregiver preference.
Results:
Overall, the FES Competence total score had a significant negative correlation with CSQ-7 total score, indicating that increased strain was associated with decreased perception of parenting competence (r=-.334, p<.01). FES Competence total score had a significant positive correlation with FES Self-Efficacy total score, (r=.470, p<.01). There was no relationship between FES Self-Efficacy and CSQ-7.
Latino caregivers total scores were higher than White or Black caregivers on both the FES Competence and Self-Efficacy subscales; however, one-way ANOVAs revealed that these differences were only significant for the Competence scale, (F(2,83) = 7.92, p<.001). Post hoc analyses indicated that mean scores were significantly higher for Latino caregivers than White caregivers for 6 of 8 individual items on the Competence scale (Table 2).
No significant differences by race/ethnicity were found for the CSQ-7.
Conclusions:
Studies have shown that although Latino parents report high levels of problem behaviors in their children, they perceive less impact of these problems on family burden. Consistent with these findings, Latino parents of children in this study did not report greater caregiver strain than parents of other racial/ethnic backgrounds. Moreover, Latino caregivers of children rated themselves higher on measures of parenting competence. Of note, many Latino parents chose to complete the measures verbally. Thus, their higher ratings of parenting competence may reflect pressure to provide socially-desirable responses. Future studies need to clarify this increased confidence in parenting abilities among Latinos and how it relates to seeking and accepting services.

156 **180.156** Feasibility of a Smartphone Application to Identify Young Children at Risk for Autism Spectrum Disorder in a Low-Income, Community Setting in South Africa

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Background:
More than 90% of children with autism spectrum disorder (ASD) live in low- and middle-income countries (LMIC) where there is a great need for culturally appropriate, scalable and effective early identification and intervention tools. Smart phone technology and application ('apps') may potentially play an important role in this regard. Here we investigated the feasibility of a mobile application that elicits and quantifies social referencing and positive emotional behaviours in young children to detect risk for ASD.
Objectives:
Our aim was to determine the technical feasibility and cultural appropriateness of the Autism&Beyond iPhone application to determine risk for ASD in children aged 12-72 months in a naturalistic, low-income South African community setting.
Methods:
Parents of typically-developing African children were recruited from community centres in Khayelitsha Township, Cape Town, South Africa. With appropriate ethicsÂ and consent, parents completed a short technology questionnaire, followed by an iPhone-based demographic and ASD-related questionnaires. Next, children were shown 4 videos of 30s each on a study smartphone while sitting beside or on a parent's lap. The smartphone front facing ("selfie") camera recorded video of the child's facial expressions and head movement. After home-based administration of the app, a subset of families were invited to participate in focus group discussions. For the purpose of this presentation, we examined 1) parental familiarity with and access to smartphones, internet and apps, and 2) parental feedback about the cultural acceptability and accessibility of smartphone technology using apps in the local community.
Results:
A total of 45 families participated in this part of the feasibility study. Parent participants had a mean family income less than $30 per week, representing the lowest socio-economic group in South Africa. The majority of parents (38/45, 84%) owned a cellphone, of which 79% were smartphones. Interestingly, no participant had an iPhone. 13/45 (29%) had email, 24/45 (53%) had a social media account, and 20/45 (44%) used WhatsApp. 10/45 (22%) had internet access at home and 6/45 (13%) and 6/45 (13%) access to WiFi. Interestingly, 27/45 (60%) used mobile data. 25/45 (55%) rated their proficiency using a cellphone as good to very good. Thematic analysis of focus group discussions indicated that families found the app relatively easy to use, and would recommend it to others in their community. Parents did not have any concerns about the fact that videos were 'American', but made a number of recommendations to localise the app. A key theme from families was the importance that the app must be free, and that data transfer should not be at a cost to them.
Conclusions:
The technical feasibility and cultural appropriateness evaluation in this very low-resource community in South Africa suggested that smartphone technology and apps may be a useful tool to reach families for early identification of ASD risk, provided the need for an android platform and free access to app and data to make this feasible. Further evaluation of the children's performance on the app, accuracy of the automated coding, and comparison with US data will extend these early observations.

157 **180.157** In Search of Culturally Appropriate Autism Interventions for Latino Families

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Background: Latinos represent the fastest growing minority population in the United States, and the proportion of Latino children with autism spectrum disorder (ASD) in early intervention programs (i.e., for children birth to 5 years of age) shows concomitant increases. Despite these changing demographics, the vast majority of evidence-based ASD interventions have been designed for and tested with mostly White, mid-upper class, monolingual English-speaking populations. Unfortunately, research suggests that interventions that are incongruent with a target population's culture may be less effective. Specifically, participation rates and response to treatment may be reduced. To either adapt current evidence-based interventions or design new interventions for Latino populations, we must have input from members of the Latino community, including knowledge of families' perceptions of intervention models and components of evidence-based practices.
Objectives: The first aim of this mixed methods study was to determine if there were quantitative differences in the ways that Latino Spanish-speaking (LSS) families and non-Latino White English-speaking (NLW) families rate the family-centeredness and helpfulness of their interventions. We hypothesized that because many evidence-based interventions were not designed or tested with LSS families, that these families would perceive lower levels of family-centeredness or helpfulness. The second, qualitative, aim of the study was to identify intervention models, strategies, and targets that are perceived as more culturally appropriate, feasible, and acceptable for LSS families, and to understand the variability that likely exists among these families.
Methods: NLW (n=27) and LSS (n=25) parents of young children with ASD completed the Family Outcomes Survey and Measure of Processes of Care as measures of helpfulness and family-centeredness of intervention, respectively. Additionally, LSS parents and other caregivers of young children with ASD shared perspectives of their child's interventions through focus groups. Topics of discussion included caregivers' level of involvement in therapy, perceptions of caregiver-mediated intervention models, as well as the feasibility, acceptability, and appropriateness of a number of several prominent evidence-based ASD strategies (prompting, video modeling, naturalistic interventions, and discrete trials) in the context of their own family.
Results: Contrary to expectations, preliminary survey results indicate that NLW parents report that intervention is less helpful in teaching parents to help their child develop and learn compared to LSS parents ($t = 2.11$; $p < .05$). However, LSS parents reported having fewer friends or family to rely on for support ($t = 2.48$; $p < .05$). Focus group participants reported a wide range of levels of involvement in therapy and perceptions of the benefits or drawbacks for specific intervention strategies. Preliminary thematic analyses revealed that parents almost unanimously wanted training and education on how to carry out interventions in the home environment even when children receive intervention in the school setting. Other themes will be discussed.
Conclusions: Findings suggest a need to provide specific, ongoing caregiver training and support to families of children with ASD, even for parents of preschool and school-age children. Specific strategies to culturally adapt interventions will be discussed. Future research should examine the benefits of caregiver training and support interventions at the preschool and school-age levels.

158 **180.158** Inclusive Education of Students with ASD in the Province of Misiones, Argentina. Support Devices, NEEDS and Views of People with ASD, Their Families and Teachers.

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Background: The central issue of our research focuses on the perception of the students with ASD, their families and the various school actors (teachers, support teachers, principals) on the processes of inclusion in mainstream schools of students with ASD in Misiones. Misiones is a province located in Northeastern, in Argentina. Its population is descended from local Aboriginal communities and European immigration. There are no epidemiological studies of ASD in the region or data known about health and educational services for people with ASD and their families. We believe that this study can initiate a deeper understanding of the topic to promote public policies that address the needs of families in the area.
Objectives: Inquire about the dynamics of educational intervention among actors (teachers, families, support teachers, students with ASD) during the process of educational inclusion in the Province of Misiones, Argentina. Identify the needs of students with ASD and their families related with support devices, access to schools and health services. Explore what human and material resources are involved in the process of inclusion of students with ASD in Misiones.
Methods: Participants: 30 students with ASD through surveys completed by support teachers, families, teachers and students with ASD included in mainstream schools in Misiones. 4 types of surveys were developed: "T" Teachers, "F" Family, "ST" Support teachers and "S" Students. The "T" survey: eighteen (18) statements and questions was given to different teachers of students with ASD. The "F" survey: nineteen (19) statements and questions was given to different family members who are responsible for students with ASD. The "ST" survey: thirty (30) statements and questions was given to support teachers. The "S" survey: thirteen (13) statements and questions was given to different students with ASD included in mainstream schools.
Results: After data collection, we will proceed to process the acquired data for further analysis and interpretation, considering the different variables and interaction of surveys.
Conclusions: In practice, the support teacher has multiple functions such as: intervening with specific support in schoolwork, promoting relationships with class teachers and peers, and advising principals and teachers. This supporting device constitutes a scaffolding which is taken away gradually. The teacher intervention includes three levels: a) the relationship between the main teacher and the student; b) the relationship between the student and his schoolmates; c) the relation with the classroom's tasks, learning process and academic skills. The figure of the support teacher points one of the possible ways of re-including students that were excluded from school. The necessary changes are not possible without inclusive educational policy proposals. The inclusive education become a key area to create educational spaces that assume a commitment to understand the difference instead of deny it or exclude it. The educational research in the area may also be a source of dialogue, growth and search for new ways of teaching. The challenge is to minimize barriers and increase opportunities for people with ASD, to guide schools through a process of inclusive school development in Latin American countries.

159 **180.159** Initial Reaction to an Autism Diagnosis of Their Young Child: Findings from Interviews with 15 Mongolian Mothers

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Background: Â Since its independent status as a democratic nation, Mongolia has worked to improve its educational system. OnlyÂ recently have the educational needs of children with disabilities come to the nation's attention. In particular, little information is available about autism.
Objectives: Â This study explored the impact of having a child with an autism spectrum disorder (ASD) on mothers and families using phenomonological theory, whereby a phenomenon that is otherwise difficult to explain "is brought to expression" (Gadamer, 1975/2006, p. 131). Two micro-level theories guided the study: (a) the relationship between mothers and their child with ASD and (b) the sociocultural context of Mongolia.
Methods: The study used a set of semi-structured interviews and the Parenting Stress Index (PSI-4; Abidin, 2012). The PSI-4, designed to evaluate the magnitude of stress in the parent–child system, focuses on three domains of stress: child characteristics, parent characteristics, and situational/demographic life stress.
The interviews and administration of the PSI-4 took place in fall of 2016 in Ulaanbaatar, Mongolia's capital. Participants were a group of mothers of children, ranging in age from 2.5 to 5.5, who had been diagnosed in July 2016. The children were enrolled in an NGO focusing on autism.
Interview questions addressed:
Initial response to the diagnosis, including that of the immediate family
Hopes and fears for the child
Changes to family life as a result of the diagnosis of ASD
Presentation of autism to the wider community
Results: Results showed that the mothers' total stress was within normal limits. However, the child domain in each instance was significantly higher than the parental domain; that is, the child with ASD was the major source of parental stress. In particular, of the seven subscales making up the child domain, distractibility, reinforces parent, mood, and acceptability, received the highest scores.
Findings showed (a) initial fear, (b) recognition of need for more information, (c) gradual acceptance of the diagnosis, and (d) determination, surrounded by varying degrees of hesitancy, to explain ASD to others in hopes of creating understanding and tolerance for the child. Mothers' hopes centered on their child's ability to live an independent life; their main worry was what would happen to the child when the parents were no longer around to care for them, given the lack of support and services. Finally, with regard to changes in the family as a result of the ASD diagnosis, most mothers noted that they had become more patient, more family-focused, and less judgmental of others.
Conclusions: While most of these findings are similar to those of similar studies in the United States, what clearly stands out is the added stress and challenge of living in a society where knowledge and understanding of autism is just emerging and services, therefore, limited or nonexistent. One of the keys to relieving parental stress came directly from the mothers. They spoke repeatedly of the need for parent training and further education. Implications for working with families with ASD

160 **180.160** Intersectoral Collaboration in Autism Screening and Surveillance - a Four Year Trend from Lagos Nigeria.

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Background: There is a recurring reminder about the need for research to be carried out to determine the burden of Autism in Africa along with the need to address the service gap and related challenges in autism care in many African countries. The perennial non availability of trained personnel which are few and scattered all over the country, making them inaccessible in many regards. Non availability of resources, lack of awareness, and lack of political will to provide solutions continue to worsen these challenges. Collaboration in providing solutions for autism diagnosis for those in need along with the willingness to explore what available options to service provision in this setting, can an be important first step. It is important that health care providers also get trained to identify and appropriately manage cases of ASD and Policymakers are encouraged to focus on providing the necessary infrastructure to manage this condition. One anticipates that when all stakeholders play a roles at varying levels there will be a more sustainable solution evolovlving to address this challenge.
Objectives: This report aims to describe the findings, processes and strengths of a community surveillance program over a period of 4 years (2013,2014, 2015 and 2016).
Methods: The GTB-CMUL autism program is a collaboration run as part of the Orange Ribbon initiative of Guaranty trust bank. The annual exercise involves two broad approaches: firstly the organizing of seminars and secondly, conducting consultative sessions with clients with features suggestive of ASDs often undiagnosed formally. Mode of recruitment is directly from community ; via email invitation, letters to special schools, verbal invitation, print media and radio jingles. Clinical evaluation sessions held over 5 day periods each year. The clinical portion findings are reported here. Clinical evaluation was conducted multidisciplinary team of volunteers. Assessments were made based on the DSM 5 Criteria for Autism.
Results: The collaborative team drawn from the private sector, public sector and academia comprised multidisciplinary professionals involved in autism care. The 4 year experience in program execution reported here showed a total of 626 individuals with neurodevelopmental disorders seen in this time frame. A significant proportion of subjects screened each year met criteria for ASD. For Majority this consultation was their first contact with formal orthodox care. Most of the caregivers suffered significant distress and were enrolled to support groups. The program consistently required to provide appropriate referrals to local services and parental inclusion to much needed support groups.
Conclusions: This program highlights how much can be achieved through team work and commitment. In the face of scarce resources committed collaborative efforts is a useful recourse to ensuring service delivery in Africa where there are little or no ASD relevant services. Monitoring, evaluation and quality assurance processes need to be continually included and reviewed in such programs going forward.

161 **180.161** Khaleeji Parents 'perspective on the Impact of Autism and Stuttering on Their Daily Life.

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Background:
Developmental stuttering (DS) arises in childhood, most commonly in the preschool years, for reasons, which are currently not well understood. Current thinking points to multifactorial underpinnings, including the interaction of linguistic, motoric, neurological, environmental and genetic influences.
It is also known that developmental stuttering (DS) can co –occur with a number of communication disorders-including Autism spectrum disorder (*Blood, Blood, Maloney, Meyer,& Qualls ,2007)*. Although there is a lack of research and a very limited evidence on the prevalence of stuttering/disfluency in children with ASD, but there have been several documented cases of stuttering in ASD (Scaler Scott et al., 2006).
Autism spectrum disorder (ASD) is a group of neurodevelopmental disorders, which manifest in the early years of the child's life and characterized by difficulties in social interaction, communication and repetitive behaviors/restricted interests, in varying degrees.Since, stuttering is the result of a number of coexisting factors and that these factors influence the onset, impact, and prognosis of stuttering (Rustin, et al., 1996), each child has his own set of factors combination that makes him/her vulnerable to stuttering (Rustin et al., 1996;Startkweather & Gottwald, 1990;Wall & Myers, 1995). Clinical experience has demonstrated that working with parents and carers to modify some of these behaviors such as slowing the rate of speech and improve turn taking, are often helpful in facilitating fluency (Stephenson-Opsal and Bernstein-Ratner 1988; langlois and long 1988;Guitar et al.,1992) .
Â **Objectives:**
To investigate 1)what are the potential factors that makes children with autism spectrum disorders vulnerable to stuttering in a non- western culture from a parent's perspective,Â 2) parental attitudes and perceptions towards stuttering and autism in Arabic culture since it has been well studied in western cultures. 3) and whether concomitant disorder has an effect on the types ofÂ service delivery to these children.
Methods:
A mixed methodology approach using self –completion, well structured questionnaire that will be distributed to around 100 – 300 Khaleeji parents (Saudi,Oman,Kuwait,Qatar)with children under the age of 18 , from different regions across the Gulf, to access their views, perception and beliefs on: the causes of stuttering and autism; strategies they have used to help their child; impact of stuttering and autism on the child's every day life;impact ofstuttering and autism on parents;level of concern and their views and experiences of the therapy process with the existence of concomitant disorder such as ASD .
Results: Results will be available in few months.
Conclusions: N/A

162 **180.162** Knowledge, Self-Efficacy, and Attitudes Toward Inclusion Among Teachers of Students with ASD in Lebanon

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Background: More children with ASD are being included in general education classrooms, consistent with the philosophy of inclusion which states that schools should adapt their practices to meet student needs (Kinsella & Senior, 2008). Successful outcomes for children in inclusive classrooms depend largely on teacher self-efficacy, which is potentially enhanced with preservice training and field placement (Atiles et al., 2012); their ASD knowledge; and their attitudes toward inclusion (Rafferty & Griffin, 2005). These are critical in low-resource countries, such as Lebanon (Obeid et al., 2015). Most Lebanese schools lack the needed support and trained staff to run effective programs for children with ASD.
Objectives: (1) To examine the effects of knowledge and stigma about ASD and attitudes toward inclusion on teacher self-efficacy at baseline. (2) To assess the impact of an in-person training lecture on knowledge about ASD, stigma toward ASD, attitudes toward inclusion, and self-efficacy of teachers.
Methods: A within-subject quasi-experimental design assessed whether the training was associated with changes in the aforementioned variables. Participants completed a pre-test, an hour-long lecture-based training about ASD, and a post-test administered four weeks after training. The training included a 63-slide presentation adapted from Gillespie-Lynch et al. (2015), involving information about ASD and inclusion, effective tools/interventions; it was provided in group sessions at two inclusive schools in Lebanon. Seventy-six teachers completed the pretest, 58 also completed the training and post-test. Measures consisted of questionnaires assessing self-efficacy, attitudes toward inclusion, knowledge and stigma toward ASD.
Results: There was a significant positive correlation between knowledge and self-efficacy; $r = .20$, $p = .044$. The model with the predictors (knowledge, stigma, attitudes toward inclusion) was not significantly better than the mean in explaining the variance in baseline self-efficacy, $F (3, 71) = 2.01$, $p = .111$.
Participants scored lower during pretest ($M = 7.57$, $SD = 4.96$) on the knowledge scale than during post-test ($M = 10.83$, $SD = 5.28$), t (46) = -4.28, $p < .001$, $r = 0.5$.
Participants had lower levels of self-efficacy at pre-test ($M = 4.06$, $SD = .49$) compared to posttest ($M = 4.23$, $SD = .44$); $t (57) = -2.55$, $p = .007$, $r = .18$.
Conclusions: Higher ASD knowledge was associated with greater self-efficacy among Lebanese teachers; this is consistent with work demonstrating that higher knowledge about strategies to support students with ASD is associated with more confidence in their ability to act as instructional leaders among administrators in the U.S. (Pazey et al., 2014). Participation in the training was associated with improved ASD knowledge and self-efficacy, which is consistent with previous research wherein online or in-person trainings were associated with increased ASD knowledge among college students and teachers (Gillespie-Lynch et al., 2015; Leblanc et al., 2009). Training teachers to work effectively in inclusive settings is critical, especially in low-resource regions where the limited inclusive schools are under-supported. Effective trainings would enhance conceptions of ASD, attitudes toward inclusion, and self-efficacy, and ultimately the process of inclusion would improve (Cross et al., 2004), leading to more inclusive schools in low-resource countries.

163 **180.163** Maternal Race-Ethnicity, Immigrant Status, Country of Birth, and the Odds of a Child with Autism

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Background:
The risk of autism spectrum disorder (ASD) varies by maternal race-ethnicity, immigration status and birth region.
Objectives:
We aimed to estimate the odds of ASD with intellectual disability (ID) in the children of women by maternal race-ethnicity, immigration status and birth region whilst adjusting for maternal age, parity, socio-economic status, and birth year of the child.
Methods:
In this retrospective cohort study, Western Australian state registries and a study population of 134,204 mothers enabled us to examine the odds of ASD with intellectual disability (ID) in children born from 1994-2005, by maternal race-ethnicity, immigration status and birth region whilst adjusting for the traits described previously.
Results:
Indigenous women were 50% less likely to have a child with ASD with ID than Caucasian, non-immigrant women. Overall, immigrant women were 40% less likely to have a child with ASD with ID than non-immigrant women. However, Black women from East Africa had more than three and a half times the odds of ASD with ID in their children than Caucasian non-immigrant women.
Conclusions:
Research is implicated on risk and protective factors for ASD with ID in the children of immigrant women.

164 **180.164** Mexican Pediatricians´ Role in the Early Identification and Intervention of Autism Spectrum Disorder

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Background: Â Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that usually manifests itself before age two.Â It principally affects a person's social communication and behavior, but impairment in other developmental domains (e.g., cognitive, motor) is frequently observed. The presence of these behaviors at such an early age provides a knowledgeable health care practitioner with an opportunity to refer a young child to a specialist in ASD to conduct a comprehensive evaluation and diagnosis. In this study, we surveyed the knowledge of Mexican pediatricians with respect to early signs of ASD as well as their perception about the challenges of treating patients with autism.
Objectives: Â N/A
Methods: Â In order to address this question, we conducted face-to-face interviews with 400 pediatricians (33% female) in private practice in Mexico City (n=200), Guadalajara (n=100), and Monterrey (n=100). In order to qualify for the interview, the pediatricians had at least 10 years of clinical experience. Our interview included questions used in other studies with adaptation to the Mexican population, including questions about prevalence, behavioral characteristics and diagnostic criteria, early signs, effective interventions and treatment, and continuing education. Each interview lasted, on average, 40 minutes. Pediatricians were paid their hourly fee for participating in the interview.
Results: Only 12% of the participants reported a number close to the actual prevalence of ASD in Mexico (1 in 115), with the remaining pediatricians reporting outdated data (between 1 in 300 and 1 in 1000). With regards to the male/female ratio, 43% of pediatricians reported the accurate 4 to 1 ratio. In relation to the diagnostic characteristics reported in the DSM-5, almost 50% of the participants correctly identified repetitive and restricted patterns of behaviors, 46% reported reactions to loud noises, 38% mentioned unusual responses to physical contact, 35% difficulties in social communication and social interaction, and 28% difficulties in the use of gestures for communication. When talking about early signs, 57% of participants correctly identified abnormal eye contact and playing alone, 47% language delays, and 39% repetitive motor movements. Only 18% of the participants reported reduced social response to name and 30% repetitive patterns of behavior as early signs of ASD. When asked about effective interventions and treatment, 36% mentioned that some form of therapy (language, behavioral and psychological) was the most effective intervention to improve the course of ASD and that follow up with neurologists and psychologists was also effective according to 34% of the interviewed. Finally, 56% reported that they participate in activities related to continued education, 40% in a Pediatrics National Conference (Mexico); however, this conference is not specific to ASD.
Conclusions: Results indicate that Mexican pediatricians have limited knowledge specific to early identification and diagnosis of ASD. Given that early identification allows for the provision of early treatment, which has been demonstrated to improve the quality of life of children and families impacted by autism, it is of utmost importance that pediatricians obtain specialized training to better serve Mexican children at risk of ASD.

165 **180.165** NEEDS, Quality of Life and Stigma of Families of Persons with ASD in Peru. Implementation of the LATIN American Autism Spectrum Network Caregiver NEEDS Survey.

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Background: ASD knowledge, services and research infrastructure in Latin America are limited and unevenly distributed. In Peru there are no epidemiological data on ASD nor accurate data on health and educational services for people with ASD and their families. This research collects data from Peruvian families to meet their needs, their quality of life and if they have suffered stigma from diagnosis of ASD. In 2015, researchers from Argentina, Brazil, Chile, Uruguay, Venezuela and Dominican Republic constituted the Latin American Autism Spectrum Network (Red Espectro Autista Latinoamerica – REAL) in order to conduct international research collaborations related to ASD. The first project undertaken by REAL was the translation, adaptation and implementation of the AS Caregiver Needs Survey. The AS Caregiver Needs Survey was developed by Autism Speaks to assess the needs of families affected by autism in partner countries of its Global Autism Public Health Initiative.
Objectives: To provide a comprehensive picture of the major needs and challenges faced by families affected by ASD in Peru with the purpose of successfully enhancing awareness, improving services, and developing long-term policy solutions related to ASD. Peru data will be compared with data obtained by Latin American countries belonging to the REAL Network (2016). Identify the characteristics of the diagnostic process regarding alerted symptoms, diagnosis time, professionals involved, distance had to travel to get the diagnosis in Peru. Knowing the perceptions of caregivers regarding: Needs; Impact of diagnostic and/or therapeutic processes in the family; Stigma associated with a diagnosis of autism; Quality of life of the family and the person with ASD; Challenges related to parenting/care of a person with autism; Initial diagnosis and/or difficult to obtain
Methods: The Caregiver Needs Survey will be broadly disseminated via social networks in Peru during a period of 4 months (November 2016-February 2017) so that caregivers can complete it online, either assisted by a clinician or not. The survey solicits information about family demographics, affected individual characteristics, service encounters and parent/caregiver perceptions, including stigma. It is estimated that more than 300 surveys will be completed in total. After the collection of completed surveys, REAL researchers will proceed to data cleaning and data analysis, and will draft a country report. Peruvian data will be compared with other Latin American countries.
Results: A summary of the results from the Caregiver Needs Survey in Peru will be presented, and regional similarities and differences will be analyzed.
Conclusions: The assessment of needs and challenges faced by families affected by ASD in Peru is essential for the identification of knowledge gaps, service needs, and stigma. It is also important in the development of culturally relevant strategies for raising autism awareness, guiding the implementation of successful and improved ASD clinical and educational services at the national and regional levels and setting priorities for future national and regional research collaborative efforts. In this era of globalization, REAL is an attempt to generate a collaborative workforce in order to readily identify the best ways to approach issues related to ASD in Latin America.

166 **180.166** Parents' Experiences and Views of Screening and Diagnostic Assessment for Autism Spectrum Disorders (ASD) in Hong Kong: A Mixed-Methods Study

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Background: A recent increase in recognition and identification of autism spectrum disorders (ASD) calls for system-level responses to addressing unmet needs of individual with ASD through the establishment of a well-integrated infrastructure for healthcare, education, social-welfare and employment. WHO states inappropriate services and a lack of resources for ASD as unjust deprivation towards vulnerable populations representing societal stigma. The first step is to develop a guideline of ASD screening, referral, diagnosis and treatment to facilitate early detection and treatment.
Objectives: The objective of this mixed-methods study was to systemically assess ASD service provisions in Hong Kong by exploring the pathway from screening, diagnosis and post-diagnosis interventions among parents of children with ASD. Narrative analysis of their experience and views aimed to represent direct sources of service-user feedbacks, informing the development of a local guideline.
Methods: A community-based survey was conducted among 249 parents of children with ASD. The instrument was developed based on the guideline for ASD diagnostic pathway of the UK National Institute for Health and Care Excellence (NICE), which includes six key milestones: (1) parental first awareness, (2) referral for assessment, (3) diagnostic assessment, (4) consultation on diagnosis, (5) post-diagnosis follow-up, and (6) entry to special education needs (SEN) program. Correlates of the key milestones were examined. The survey also included open-ended questions about their experiences and views on each key milestone to contextualize the quantitative findings.
Results: About half of parents (51%) were first aware of child's differences by the age of 2 and 70% sought professional help within 3 months. Fifty six percent saw multiple professionals for referral. Significant delays were reported between screening/referral (R), diagnosis (D), post diagnosis follow-up (F), and entry to SEN: 88% were delayed between R and D (>3 month), 60% D and F (>6 weeks), and 70% D and SEN (>3 months). Low income was associated with longer time in access to diagnosis and follow-up. While a shorter time in access to diagnosis was reported after the launch of behavioral surveillance, no effect of the surveillance was found in the time for access to F/SEN. Parental satisfaction was significantly associated with quality of assessment and shorter time for treatment. Parents expressed difficulty and high anxiety with coping with uncertainty while waiting for assessment. Experience of multiple consultations for referral and long delay caused lack of confidence in ASD treatment and care as they felt "missing golden times." They expressed the special need for family needs assessment when they were given ASD diagnosis for child.
Conclusions: The findings indicated considerable delays and lack of coherence and resources in ASD assessment and SEN provisions in Hong Kong. Policy of standard care should provide guidelines of (1) monitoring pre-school children for ASD in pediatric settings, (2) how to inform parents of ASD symptoms and what information to be provided for waiting time, (3) comprehensive needs assessment for child and family, (4) evidence-based treatments, and (5) follow-up protocol for re-assessment on child development and needs.

167 **180.167** Positive Contact Decreases Stigma Associated with Autism Spectrum Disorder – Study through Interviews with Japanese High School Students

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Background: Autism spectrum disorder (ASD) is often misunderstood in Japan (Koyama et al., 2008), and the stigma associated with ASD on the part of Japanese college students was higher than that of their American counterparts (Someki et al., 2015). In contrast, accurate knowledge about positive outcomes of people with ASD contributed to less stigma (i.e., less social distance) on the part of Japanese high school students (Torii et al., 2015). Further, accurate knowledge of ASD and opportunities to learn about neurodevelopmental disabilities (ND; e.g., ASD, learning disabilities, attention-deficit/hyperactivity disorder) both correlated with less stigma associated with ASD.
Objectives: The purpose of this study was to examine the relation between previous experiences (i.e., direct interactions) with peers with ND during elementary and middle school years, knowledge about ND, and the level of stigma associated with ASD.
Methods: The data were gathered through both interviews and a survey. Semi-structured interviews were conducted by four high school students of their peers in an urban city in Japan. A total of 69 high school students (23 males, 46 females) participated in the interviews and survey. The interview protocol consisted of six questions about previous interactions with peers with ND, and how they (interviewee) felt during that interaction, their anxiety about interacting with peers with ND, and their friendship with peers with ND. In addition, each participant completed a questionnaire using 5-point Likert-scale. The questionnaire consisted of 26 items: 4 items about knowledge about ASD, 6 items about knowledge about ND, 5 items about life style, 5 items about attitude toward people with ND, and 6 items about social distance (SD) towards individuals with ASD (i.e., stigma measure: Bogardus, 1933).
Results: The ASD Knowledge mean score was 2.36 (SD= 0.56), and Social Distance mean score was 2.03 (SD= 0.76, Fig.1) A lower score indicates more accurate knowledge and less stigma. The mean Social Distance score was correlated with the following items: mean Knowledge about ND score ($r = .486$, $p < .01$), Knowledge about ASD ($r = .445$, $p < .01$), " I have no prejudice towards anyone" ($r = .320$, $p < .01$), "Behaviors by peers with ND need to be tolerated (reverse item)" ($r = .340$, $p < .01$), "I would make friends with peers with ND" ($r = .397$ $p < .01$). Female students were less likely to make friends with peers with ND ($r = .308$ $p < .01$). than males (Table 1). Students also provided some examples of positive interactions with peers with ND. Namely, "My teacher treated us fairly regardless of the presence of ND" and "I had fun playing with peers with ND." Further, students also listed examples of negative interactions, such as "Peers with ND were violent" and "I was harassed by peers with ND."
Conclusions: Positive interactions with peers with ND during elementary and middle school years were significantly correlated with reduced stigma associated with disabilities on the part of high school students.

168 **180.168** Sleep and Behavioral Disturbances in Children with Autism Spectrum Disorders: Evidence from India

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Background: Sleep problems are considered a common clinical characteristic of children with autism spectrum disorders (ASDs). Little evidence is, however, available on sleep related difficulties in children with autism from developing countries leading to major gaps in the knowledge about children with autism from the majority world and the needs of these children.
Objectives: Â To compare parent reported sleep problems of children with ASD and typically developing children and to study the association of sleep problems with daytime behavioral difficulties in children with ASD.
Methods: Â Sixty children diagnosed with ASD (Mean age= 6.1 years, SD=2.4) were recruited from the Department of Pediatrics of a tertiary care teaching hospital in India. An age and socio-economic status matched group of typically developing children (N=60) were also recruited. The Children's Sleep Habits Questionnaire (CSHQ) was used to measure sleep problems. The 33 items scale assesses resistance to bedtime, delay in onset of sleep, duration of sleep, parasomnias, sleep-disordered breathing, sleep anxiety, awakenings at night, and daytime sleepiness. The Childhood Psychopathology Measurement Schedule, the Indian adaptation of the Child Behavior Checklist, was used to measure day time behavioral difficulties. The study was approved by the ethics committee of the Institute and a written informed consent was taken from all the parents/caregivers.
Results: The prevalence of sleep problems in children with ASD was 88%, nearly twice as more as compared to controls (47%). The ASD group as compared to typically developing children had significantly higher total scores on the CSHQ (t= 5.3, P=.001) and more sleep related problems (t =3.6, P=.001). As compared to controls, significantly higher proportion of children with ASD reported bedtime struggles (25% vs. 7%, P=.001), problems in initiating sleep (28% vs. 0 %, P=.001), sleeping for inadequate duration (30% vs. 1%, P=.001), frequent sleep disruptions (28% vs. 13%, P=.006), not falling sleep in own bed (72% vs. 38%, P=.001), afraid of sleeping in the dark (32% vs. 13%, P=.002), and bed wetting (13% vs. 2%, P=.02). A significant correlation was found between sleep and daytime behavioral problems (r=0.53, P=.01). Sleep difficulties of the ASD children did not differ by socio-economic status, education of the mother, autism severity score as measured by the Childhood Autism Rating Scale (CARS) score.
Conclusions: Children with ASD are at a high risk for sleep problems and this may be associated with daytime behavioral difficulties. Clinicians should routinely screen ASD children for sleep problems and initiate appropriate interventions.

169 **180.169** Supporting Practitioner Responses to Attitudes to Autism and Intellectual Disability in Black and Minority-Ethnic Families in the UK and Beyond

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Background: Black and minority-ethnic (BAME) families living in the UK may struggle with the presence of autism and / or intellectual disability in their family members. This is particularly challenging for recent immigrants to the UK and those living in communities where a large majority of people are white British, such as Edinburgh, Scotland.
Objectives: This project combines focus groups, literature review and an online survey to explore the challenges experienced by practitioners supporting BAME families in Edinburgh and to provide evidence-based recommendations for their practice.
Methods: We worked with a charitable organisation providing support to BAME families in Edinburgh. Stage One was a focus group with practitioners from the organisation to discuss the challenges they perceive when providing support to BAME families. Topics were organised into questions about: 1) practitioner challengers; 2) family challenges; and 3) useful resources. Stage Two was a literature review aiming to address two questions derived from the focus group analysis: *How do cultural attitudes to autism and intellectual disability vary worldwide?* and specifically *How can the research literature help practitioners understand attitudes to autism and intellectual disability in BAME families in Scotland?* Stage Three (in progress) will be the design and evaluation, via a practitioner survey, of a website sharing evidence based information about cultural attitudes to autism and intellectual disability. The site will report information about how attitudes vary among different ethnic and religious groups and extract some simple tips for practitioners on working sensitively with BAME families.
Results: The focus group data were analysed thematically and revealed challenges in three domains. 1) Practical Challenges – these included isolation, language barriers and financial barriers (e.g. lack of transport to visit clinical services). 2) Attitude Challenges – these included culturally-specific beliefs about disability (e.g. disability as a punishment) and resulting behaviours. 3) Knowledge Challenges – this encompassed practitioner uncertainty about culturally-sensitive ways to respond to stigma. The BAME community in Edinburgh is highly diverse meaning that it is challenging for one practitioner to be familiar with the range of cultural backgrounds they encounter among clients. Furthermore, specialist practitioners must then refer to diagnostic and support services who have even less experience of BAME families. The Stage Two literature review adopted a systematic search methodology to identify texts which either a) described cultural / religious variation in attitudes to autism and intellectual disability or b) reported on mechanisms to support people experiencing stigma associated with disability. These findings are now being organised into a resource designed to address Knowledge Challenges among practitioners so that they in turn can deal with Attitude Challenges in the community.
Conclusions: We will report on a survey-based evaluation of the finished website (Stage Three, in progress) as well as providing further details of the literature search results. This study reveals the challenges presented to autism diagnostic and support services by increasing multi-culturalism and can help researchers, practitioners and the community sensitively address stigma as well as identifying gaps in our knowledge.

170 **180.170** The Experiences of Special Needs Teachers Working with Children with ASD in Tanzania

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Background: Autism Spectrum Disorder (ASD) is a worldwide phenomenon. There are however large disparities in provision of service for children with ASD around the world (Elsabbagh, 2012). In Africa, many countries lack ASD prevalence data, and limited information on services available (Ruparelia, et al. 2016). One preliminary estimate regarding the number of children with ASD in Tanzania was 437, but is limited to results reported from 15 different intervention centers and considered to be a gross underestimate (Manji & Hogan, 2013). Teachers at the centers reported minimal additional training, and there is a need for substantial increase in facilities and human resources to support children with ASD in Tanzania.
Objectives: Gain more information about the number of children with ASD being serviced in two areas in Tanzania and the qualification and experiences of the teachers working with the children
Methods: This was part of a larger research project that examined special needs teachers' learning outcomes at a training on ASD in two regions of Tanzania, Dar es Salaam (Dar) and Arusha. In this study, 66 special needs teachers from 19 different schools completed the Teacher Feedback Survey (West, Jones, Chambers & Whitehurst, 2012). Survey questions included demographic information, qualifications, professional development experiences, number of children taught, and number of children identified as ASD.
Results: The mean age of the participants 40.5 years old with the majority female (74%). Data was organized based on the following categories; work setting (mainstream setting: 32%, special unit: 67%, and other: 4 %); type of degree (Certificate or Diploma); number of children serviced (1,110 total, Dar= 540, Arusha= 570) and age range of children (4-21 years old). The numbers of children were divided by disability categories (identified by the teachers), which included 218 children with ASD, 527 with intellectual disabilities and 27 with hearing and vision impairments. Fifty- three percent of the teachers reported participating in mentoring activities, and 66% reported that they participated in additional training courses.
Conclusions: Results provide preliminary data on the number of children with special needs who received special education instruction in two urban centers in the country. It is not possible to confirm diagnosis of ASD or ID reported due to a lack of assessment facilities in the country or Africa as a whole (Ruparelia et al., 2016), and numbers are based on teacher report alone. Results add to the literature regarding tentative total numbers of children identified as having ASD in two urban areas in Tanzania, along with information regarding the qualification and training of the teachers who work with them. These numbers are almost certainly significant underestimates and do not capture the numbers of children with developmental disabilities in other parts of the country. It is imperative to know the rates of developmental disabilities including ASD in Tanzania and in the rest of Africa so as to advocate for much needed intervention services for these children and their families and provide additional training and resources to teachers and community members who support children and families.

171 **180.171** Assessing Knowledge of Autism Spectrum Disorders (ASD) in Tanzania; Results from an Intensive Four-Day Training on ASD for Special Educators

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Background: Autism Spectrum Disorder (ASD) is a worldwide phenomenon. There are however large disparities in provision of service for children with ASD around the world (Elsabbagh, 2012). In Africa, many countries have small number of professionals dedicated to working with children with ASD. Recommendations to address this include increased engagement with community stakeholders, increase in access to information about ASD, and specific trainings on ASD in community settings (Ruparelia et al., 2016).
Objectives: An examination of results from a pre and post-test measure of ASD knowledge given during two ASD trainings for special education teachers in Tanzania.
Methods: The 20-hour, four-day training occurred in two special needs units in primary schools in Dar es Salaam (Dar) and Arusha, Tanzania in July and August 2016. A total of 79 special education teachers attended the training (Dar, N=39; Arusha, N=40). The training was run by five clinicians from the U.S based non-profit, OMPACO in partnership with special needs units in each location. Topics covered during the training included etiology, characteristics, assessment, instructional and communication strategies, behavior management and sensory processing. Learning outcomes of the training were assessed using a pre-post test methodology with a 19-item measure, the "Autism Knowledge Survey" based on items taken from the "Autism Survey" (Schwartz & Drager, 2008). All items were translated into Swahili and then back translated into English for accuracy.
Results: Â Reliability results were fair (Cronbach alpha= .428). Results from paired-samples t-test indicated a significant difference in scores in Dar, t (31) = 3.22, p< .001 and in Arusha, t (37) = 7.46, p< .001 with effect sizes that were medium in Dar (Cohen's d= .569) and large in Arusha (Cohen's d= 1.209). An analysis of variance between pre and post-test scores was significant for location, F (1, 67) = 15.97, p< .001 with a larger increase in scores on the measure in Arusha.
Conclusions: There was an increase in ASD knowledge on the measure in both locations with a significantly greater increase in scores in Arusha. Reasons why were hypothesized to be multifactorial and included the presence of a translator in Arusha, differences in perception regarding collaboration and partnership between OMPACO and the sponsoring schools, longer travel times for teachers to reach the training site in Dar (teachers came late or missed days of the training), and differences in the facilities provided for the trainings.The low internal consistency result may be because the measure only assesses one construct (characteristics of ASD). It is not possible to compare the alpha value to that of the original measure as no reliability statistics were reported. The reliability finding can be framed within a broader discussion about the need for culturally reliable and valid measures of ASD knowledge. Improved measures that assess different domains of knowledge related to ASD would better reflect learning in different content areas covered in a multi-day training. This could in turn increase specialized knowledge in multiple content areas to key stakeholders working in the field of ASD in Tanzania.

172 **180.172** The Use of M-CHAT (Malay version) As a Screening Tool for Pervasive Developmental Disorders in Malaysia

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Background:
The Modified Checklist for Autism in Toddlers (M-CHAT, 1999) was translated in 2008 to Malay, the Malaysian national language (M-CHAT-Malay Version; MCHAT-MV). MCHAT-MV has been used nationwide in maternal and child health clinics in Malaysia from 2012 until the present time. Typically MCHAT-MV would be given to parents by community nurses if there were developmental or behavioural concerns. The results would guide nurses regarding referrals to tertiary diagnostic autism services or to the clinic medical officer. A small initial validation study of MCHAT-MV was performed but there were no subsequent studies. There are no Pervasive Developmental Disorders (PDD) screening tools used for children above 30 months in public health services.
Objectives:
The objective of this study was to determine the sensitivity and specificity of the MCHAT-MV as a screening tool for PDDs in children aged 18 to 60 months with developmental or behavioural problems. Optimal cut-off scores were also evaluated.
Methods:
A prospective study was done in the Child Developmental Centre (CDC) of a tertiary hospital from 1st April 2010 until 31stMay 2012. Parents of children aged 18 – 60 months referred as new cases for developmental or behavioural difficulties, were given the MCHAT-MV to fill in before clinical assessments. The diagnosis of PDD was made after 2 clinic appointments, including a developmental assessment, multi-disciplinary discussion and semi-structured interview and clinical observation byÂ experienced developmental pediatricians using criteria from the Diagnostic and Statistical Manual of Mental Disorders 4th Edition, Text Revision (DSM IV-TR). Diagnosis of other developmental- behavioral disorders were made by developmental pediatricians.
Results:
A total of 130 patients were enrolled and categorized into two main groups, the PDD group and Other Developmental-Behavioural Disorder (ODB) group. The PDD patients were diagnosed with Autistic Disorder (n=50) and Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS) (n=13).Â The ODB patients were diagnosed with Global Developmental Delay (n=20), Specific Language Impairment (n=41) and Attention Deficit Hyperactive Disorder (n=6). The MCHAT-MV was found to have the sensitivities and specificities respectively for the corresponding age-groups: overall 18-60 months (n=130), 88.9% and 47.8%; 25-30 months (n=38), 100% and 45.5%; aged 37 – 48 months (n=59), 90.3% and 57.1% and 49 – 60 months (n=27), 80.0% and 50%. Children aged 18-24 months were not analysed in a stratified age group there was only 1 child with autistic disorder. Overall positive predictive value (PPV) was 61.5% while negative predictive value (NPV) was 82.0%. Optimal cut-off values to detect PDD based on the Receiver Operator Characteristic (ROC) curve were failing 1 out of the 6 critical items or 3 of 23 total items from the MCHAT-MV.
Conclusions:
MCHAT-MV is a sensitive screening tool for detecting Malaysian children with PDDs in an expanded age group of 25 – 48 months old in this selected population. The original cut off value of 3 of 23 total items can be used in our population, however further studies are needed to determine the cut-off value for critical items. All children failing MCHAT-MV will require further evaluation due to moderate specificity.

173 **180.173** Training Parents in Saudi Arabia to Implement Discrete-Trial Teaching with Their Children with Autism Spectrum Disorder

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Background:
Applied Behavior Analytic (ABA) services for children with autism in Saudi Arabia are presently scarce. Children with autism who could benefit from such services are unable to obtain them. Involving parents in the implementation of certain ABA techniques may help increasing the number of children who may benefit from the training.
Objectives:
The present study evaluates the effects of a behavioral skills training package on parents implementation of discrete-trial teaching with their children with Autism Spectrum Disorder.
Methods:
Three parent-child dyads participated in the study. The effects of the training package on parent implementation and child responding were evaluated using a multiple-probe design. The primary dependent variable was parent implementation of Discrete Trial Teaching . Specifically, parents were scored on the extent to which they: 1) completed a brief mini-preference assessment (choice between two items); 2) required eye contact with the child for at least 1 second prior to the instruction; 3) waited until the child was ready (i.e., no problem behavior) before providing instructions; 4) gave a clear instruction relevant to the task; 5) implemented a least-to-most error correction procedure within 5 s of the instruction after the student failed to respond or responded incorrectly; 6) provided immediate reinforcement for correct responses (using item identified in #1); 7) used behavior-specific praise; and 8) recorded the data for each trial. Child behavior was also measured throughout, and consisted of the child engaging in the correct response (specific to the instructional task) within 5 s of the discriminative stimulus.
Results:
The training package improved implementation for all three of the mothers. Moreover, these improvements generalized to skills that were not taught during training, maintained during follow-up probes, and resulted in improvements in child behavior.
Conclusions:
Overall our results support pervious published studies using this behavioral skills training. The results of the present study show that a brief Behavioral Skills Training program can improve the implementation of discrete-trial teaching with parents of children with ASD in Saudi Arabia.

174 **180.174** Training Parents in Saudi Arabia: Assessing Learning from Doing and Learning from Seeing

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Background: A considerable amount of attention has been given to parent training efforts in Applied Behavior Analysis. Still, much remains to be learned, including the extent to which common training protocols are effective with a diverse range of individuals and are viewed as socially valid in different cultural contexts
Objectives: To evaluate the effectiveness of behavioral skills training and observational learning in parents training in Saudi Arabia
Methods: The present study trained six parents of children with Autism Spectrum Disorder to implement the Natural Language Paradigm in Saudi Arabia. Three of the parents received training using a Behavioral Skills Training model involving instructions, modeling, rehearsal, and feedback. The other three parents observed the whole training procedure and then recieved behavioral skills training based on their performance post observation. The effect of training package on parent implementation was evaluated using multiple-probe design.
Results: All three of the participants who were taught using this protocol learned to implement the intervention effectively. As each parent was being trained individually, an additional parent observed the training (i.e., there were three observer-trainee dyads). While all of the parents learned from observing other parents being trained directly, only one observer parent met the predetermined performance criteria, with the other two reaching criteria after being trained directly. All six parents demonstrated maintenance of their skills at follow-up, and indicated that they enjoyed and training and learned a lot from it. Moreover, parents indicated that their child's behavior improved at home, suggesting strong social validity
Conclusions: The behavioral skills training is effective in training parents. The observational learning has considerable effect in parent training , however it is not adequate enough in learning process.

175 **180.175** Transition of Adults with Autism Spectrum Disorders in the U.S. and China: Lessons Across Cultures

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Background:
Recent developments in both China and the US have led to changes in service opportunities for adults with developmental disabilities (People First Transformation, 2016; Swanson, 2014; Xu, Dempsey, & Foreman, 2014). While many of these changes are positive, and have led to increased choices in services, it is unclear how adults with disabilities and their families are actually experiencing these policy and service changes. While some research has presented examples of intervention programs designed to help students with developmental disabilities transition from high school to adult life (Hagner, Kurtz, Cloutier, Arakelian, Brucker, & May, 2012), other very recent research in the US has found that families experience the transition to adult services to be a stressful process with many unmet needs (Cheak-Zamora, Teti, & First, 2015). In China, there is less research about adults with disabilities; what is available indicates that while adult benefits and services previously were often on a case-by-case basis (McCabe & Wu, 2010), there is increasing attention to vocational programs and adult services (Xu, et al., 2014).Â
Objectives:
At a time of transition in service provision systems in both countries, this study examines the perspectives of beneficiaries of services and service providers, to understand the advantages and challenges that exist in these different services systems (China and the United States). This research investigates the lives of adults with autism and/or intellectual disabilities in China and the United States to gain an in-depth understanding of disability and disability services in adulthood from the perspectives of important stakeholders, including the person with a disability, parents and other family members, current and past service providers, and other important members of each individual's life.
Methods:
This research uses a qualitative multiple case study approach (e.g., Yin, 2009) focusing on the experiences of eleven (5 US, 6 China) transition-age adults with developmental disabilities and their families and service providers. Interviews were guided by semi-structured interview protocols and lasted up to an hour and a half. In addition to interviews, document analysis was conducted with relevant policies, as well as brochures, reports, and websites from any disability-relevant agencies with which the family is involved.
Results:
Qualitative analysis of data led to three main themes. First, there is a tension between promoting the right to make one's own decisions versus supporting emerging adult role & responsibilities. Second, while parent advocacy is essential and makes a difference, there are limits. Adult outcomes are varied, especially in China, due to local services (or lack of), and parent efforts. Finally, results indicate some of the emerging impacts of policy changes in US and China, including advantages and continued challenges.
Conclusions:
Â There are some similar experiences of adults with autism in China and the United States, but due to different policy and educational contexts, the specific nature of the experiences and challenges differ. Together, the experiences of participants in the study indicate that finding best practice solutions for adult services is an ongoing issue, and lessons are to be found in both countries.

176 **180.176** Trends in Autism Research Funding in the Arab World

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Background: Autism Spectrum Disorder (ASD) research in the Arab world is a young but rapidly growing field. Research funding will keep the cycle of this field's growth going and shape the next wave of evidences that will enhance the recognition, understanding, and awareness of ASD in the region. Little information about who is funding ASD research and what type of research being funded.
Objectives: The purpose of this study was to identify: a) the organizations that funded ASD research in the Arab countries, and 2) types of studies are being funded.
Methods: ASD research publications produced in the Arab countries from 1946 to 2014 were screened using four databases: Medline, PubMed, Web of Science and EMBASE. A total of 142 publications were identified, spanning a period from 1992 to January 2014.
Results: Over a third of all ASD articles (40.8%) from the Arab world included 58 funding acknowledgments representing 21 unique funders. The majority of funding sources were governmental agencies (n = 53), whereas little research was funded by private organizations (n = 9). A total of six studies were funded through collaborations between governmental, private, and international funding organizations. Three funders that were acknowledged on ten or more publications included: King Abdulaziz City for Science and Technology, Riyadh, Saudi Arabia; King Saud University, Riyadh, Saudi Arabia; and Sultan Qaboos University, Muscat, Sultanate of Oman. The majority of funding acknowledgments were in publications that addressed basic science research
Conclusions: Funding organizations that were acknowledged the most are in two countries that actively engaged in ASD research: Saudi Arabia and Oman. Indicating that ASD research is a priority in such countries, this finding is consistent with existing literature from the US, showing that states that received most of Federal health-related research funds published most of ASD research (Interagency Autism Coordinating Committee 2012). Funding organizations in the Arab world need to invest in various research areas in order to improve and manage the ASD field effectively. Private organizations in the Arab world should do their fair share to fund ASD research, allowing many potential researchers to reach the required funds for research.

177 **180.177** Validation of the Com Deall Developmental Checklist and the Com Deall Oro-Motor Assessment in Normative and Autistic Populations in India: Linking Motor, Cognitive, and Speech and Language Skills

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Background: The many tools globally available for assessment of autism spectrum conditions lack culturally specific adaptations and norms. Whereas social cognitive impairments were once assumed to be primary, early signs of motor speech impairment have gained importance in explaining uneven language profiles in non-verbal autistic children. Motor deficits in children with ASD range from motor delay and motor asymmetries to oro-motor impairments, as well as praxis of limb movements and speech movements. These basic traits of motor dysfunction and dyspraxia correlate with the severity of autism's more immediately apparent, more diagnostic, and more debilitating social communicative deficits, and can impair the later development of social communication and language. Especially because remediation of these basic motor deficits can benefit later communicative development, validated, culturally appropriate, and economically accessible tools are needed to quantify the effects of intervention.
Objectives: To validate against international norms the Com DEALL Developmental Checklist (CDDC) and the Com DEALL Oro-Motor Assessment (CDOMA), low-cost instruments indigenously developed, normed, and tested in India. These culturally adapted and economically accessible test-retest measures assess autistic skills and deficits in motor and particularly oral motor development, receptive and expressive language, and adaptive skills, at baseline and during intervention.
Methods: CDDC and CDOMA were cross-validated against the Mullen Scales of Early Learning (MSEL) and the Verbal Motor Production Assessment for Children (VMPAC), respectively, in 60 children with ASD attending the Com DEALL programme and 155 typically developing children. All subscales of all tests were assayed for correlation against each other, exploratory factor analysis was applied for each diagnostic group separately, and a linear discriminant between groups was constructed with leave-one-out validation for each test separately.
Results: All subscales common to MSEL and CDDC correlated with each other, although correlations with MSEL gross motor and visual reception diminished with age. Nearly all VMPAC subscales correlated with the CDOMA Tongue Movement subscale and most strongly with the CDOMA Speech subscale. The CDDC correctly classified 96.3% of the participants into ASD and age-matched typical groups, with leave-one-out cross-validation; controls were classified more accurately (99.2%) than children with ASD (86.7%). The CDOMA correctly classified 85.8%, controls again more accurately (99.2%) than children with ASD (60%). Cognitive and social skills segregated with language in typical development, but with motor skills in ASD.
Conclusions: Whereas the factor structure of oro-motor assessments in the typical group describes the type of motor or cognitive control assayed (motor control versus sequence maintenance) independently of the complexity of speech production (sounds versus words versus sentences), in the autistic group the variance between factors is a matter of complexity of production, cutting across type of control. These results validate CDDC and CDOMA, suggest a link between autistic motor and cognitive control, and suggest that autistic speech impairment is complexity-specific.

178 **180.178** The Expression, Recognition and Reporting of Autism Symptoms in the Ethiopian Context

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Background: To improve detection of autism worldwide a better understanding is needed of the cultural-specific expression of autism symptoms and the cultural-specific ways of recognising and reporting autism symptoms. A good understanding of these factors is essential for establishing a valid screening tool for use in low-income countries like Ethiopia, where autism is underdiagnosed.
Objectives: To explore the cultural-specific expression, recognition and reporting of autism symptoms in Ethiopia.
Methods: Audiotaped semi-structured interviews were conducted with 16 caregivers of children with autism, recruited through Yekatit 12 hospital's child mental health clinic in Addis Ababa, and with 8 local clinical professionals with autism experience. Informants were asked to describe the child's strengths and difficulties, and the main areas of concern for the caregiver. Probes included autism characteristics listed in international diagnostic criteria. Data were analysed using framework analysis.
Results: Most caregivers identified strengths of their children ('*He is so sweet… It is the kid you most like to live with*') and appreciated the opportunity to describe strengths alongside problems. Clinicians and caregivers both provided examples of all main diagnostic symptoms of autism. Informants described impaired social relationships, ranging from the child preferring to be alone to having difficulty making friends. Problems with social communication were prominent: most caregivers indicated they have difficulty understanding what their child wants or needs. Restricted repetitive behaviours and activities were reported too, including repetitive play (e.g. splitting grass), sensory sensitivity (e.g. disturbed by loud noises or strong odours), insistence on sameness (e.g. wearing the same clothes; dislike of new foods) and motor stereotypies (e.g. hand flapping or head movements). Both caregivers and clinicians most frequently mentioned lack of speech as the cause of first concern. When asked which characteristics were most challenging, the majority of caregivers raised the child's inability to communicate, but several also mentioned severe behavioural problems or lack of self-help skills, especially toilet problems.Â While caregivers could easily describe their primary concerns, there was also evidence of lack of awareness of some core symptoms. One caregiver commented:Â *'I only start thinking about this thing [non-verbal communication problems] now that you raised it. We never see him showing us signs for what he agrees or disagrees with. We never thought of that.'Â* Moreover, several interview comments suggested that symptom reporting may be affected by beliefs, especially the common belief that autism is due to the child being spoilt.
Conclusions: In this exploratory study from Ethiopia, there was no indication that the expression of core autism symptoms differs markedly from what is reported in Western countries. However, due to local belief systems, cultural norms and low levels of awareness it is likely that some core symptoms would be missed when using a standard Western autism screening tool. In a context of low awareness a broad question about e.g. toilet problems may hold high predictive power even when screening for a specific condition like autism. The findings of this study suggest that in order to avoid low sensitivity, existing caregiver-reported screening tools will require careful cultural adaptation.

179 **180.179** Development, Adaptation, and Implementation of a Parent-Mediated Behavioral Intervention for Children with Autism Spectrum Disorder in Rural Bangladesh

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Background:
It is often difficult to provide interventions for autism spectrum disorder (ASD) in low and middle-income countries (LMICs) since LMICs often have limited resources, underdeveloped health systems, and scarce ASD knowledge. Community-based strategies where caregivers or family members are interventionists may provide sustainable treatment for children with ASD in LMICs. Gaibandha, a rural district in northwestern Bangladesh, has low literacy and income levels. Families of children with ASD in this district are in great need of means to improve child communication skills and reduce challenging behaviors. Feasible, low cost and sustainable approaches to deliver ASD services are crucial in addressing needs of families of children with ASD in communities like Gaibandha.
Objectives:
To develop and adapt culturally appropriate educational materials for families of children with ASD and to train a local clinician to use these materials to implement a community-based parent-mediated behavioral intervention in Gaibandha.
Methods:
This study was built on of the infrastructure of JiVitA, a long-standing research program that works to improve maternal and child health outcomes in Gaibandha. Our study sampled participants from a prevalence study of ASD in children seven to nine years old that were offspring of a JiVitA cohort. Study investigators were trained in behavioral modification techniques and developed a training program for a local clinician. The program emphasized the fundamental principles of behaviors as well as ASD specific intervention. The study investigators assisted the local clinician in the creation and adaptation of educational materials that focused on understanding developmental milestones across domains and using behavioral modification techniques. All materials were carefully adapted to cultural norms and literacy levels of the Gaibandha population. For example, using culturally appropriate pictures to minimize the use of written words, and adapting concepts that are understandable to local parents who have very little formal education. The local clinician delivered group education sessions to ten families of children with ASD, followed by two one-on-one sessions with each family to discuss individualized strategies and coach parents. A brief qualitative survey was conducted at the end of the sessions to evaluate the program.
Results:
The local clinician successfully delivered the educational program, shared materials and worked one-on-one with families. Preliminary qualitative results indicate the importance of materials that are culturally appropriate and at a proper literacy level. Parents and caregivers were vocal in their need for support and tools to help their children. All families indicated that they wish they were trained with these skills when their child was younger and lamented the difficulties and stigmas of raising a child with ASD in their community.
Conclusions: Families indicated that the intervention was effective and expressed their gratitude for the support. By working to support families earlier, it may be possible to lessen the stigma and parental stress that impacts families of children with ASD in Gaibandha. We believe that this study is the first step in creating a sustainable and low resource intervention to aid families of children with ASD in rural Bangladesh or other communities share similar societal and cultural background.

180 **180.180** Adapting and Testing a Parent Education Program in Colombia

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Background: ASD affects approximately 1% of the world's population and many children with ASD around the globe, including in Latin America are not receiving the supports needed due to services being limited or not available. In collaboration with a team from the Universidad Nacional de Colombia, Bogota we adapted and pilot tested a parent educational intervention, *Parents Taking Action*(originally developed for Latino immigrant parents of children with ASD in the USA) for parents in Colombia. The intervention uses community health workers or promotoras which is a mode of intervention widely used internationally and is a cost-effective way to deliver education about health conditions and disabilities.
Objectives: In this study we compared two groups: families who received the intervention delivered by parents of children with ASD (parent promotoras), and families who received the intervention delivered by therapists in training (student promotoras). Our research questions are 1) did parents improve on parent outcomes between pre and post-test in the overall sample? and 2) were there differences in parent improvement between those who had parent promotoras and those who had student promotoras?
Methods: Parents of children with ASD were recruited through an inclusive public school in Bogota, and 26 were enrolled in the study and randomized to the 2 groups. Parent outcome measures included the Family Outcome Scale (FOS), the Center for Epidemiological Studies Depression Scale (CES-D) and a scale developed by the authors to measure use of evidence- based strategies. Paired sample t-tests were used to analyze pre and post-test changes and repeated measures of analysis of covariance (ANCOVA) were used to analyze differences between the 2 groups.
Results: Twenty parents completed the study indicating a 77% retention rate. Overall sample results show that parents improved on subscales from the FOS: Understanding child's strengths and needs, helping child develop and learn, and having support systems between pre and post-test. Also parents improved in their use of evidenced-based strategies, and reported fewer depressive symptoms. We found that outcomes differed by group, parents who had student promotoras reported fewer depressive symptoms at post-test, and improved on helping their child develop and learn, and having support systems, while parents who had parent promotoras improved on understanding their child's strength and needs. Both groups improved on the use of evidence-based strategies.
Conclusions: Our findings suggest that using promotoras to deliver parent education shows promise with improving parent outcomes for parents of children with ASD in Latin America. Furthermore, both parent and student promotoras led to positive changes in parent outcomes. However, there were more positive outcome results for parents who had student promotoras. Because students can often participate as part of an internship for their professional training, these findings demonstrate a promising parent education intervention that can be cost-effective.

181 **180.181** Employing Niche Construction to Clarify Ethical Responsibilities in Cases of Autism Spectrum Disorders

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Background: Â Appropriate understandings of autism depend crucially on understanding the behavioral context of persons with autism. Diagnosis and treatment involve assessments of "deficits in social communication and social interaction" that hinge on claims about successful functioning in social contexts. Identical neurological conditions can produce significant differences in functioning in different contexts, and this has profound (and contentious) implications for ethics and disability rights, as can be seen from the jurisprudence on the CRPD. What remains fundamentally disputed is the correct way of conceptualizing the interconnections between impaired functioning and the (un)supportive environment. Hence, debates between the "medical model" and the "social model" have reached an unproductive deadlock. Recent work in philosophy of mind and cultural evolution provides a useful tool for reframing these disputes and thereby clarifying the nature of ethical responsibilities in case of ASD. Building on empirical and theoretical work demonstrating human cognition to be "extended, embedded, embodied, enacted, situated, and distributed", a new paradigm has emerged that incorporates elements from evolutionary theory to reveal the role of "niche construction" in enabling individuals to function effectively.
Objectives: Â The objective of this study is to assess the prospects for employing the model of niche construction to clarify the interconnections between impaired functioning and the (un)supportive environment and thereby to clarify the nature of ethical responsibilities in cases of ASD.
Methods: Â This study employs research methods that are both theoretical and data-driven. The theoretical methods involve conceptual analysis of claims regarding "functioning," in light of the inferential implications of competing models. The data come from recent studies showing the effects of "scaffolding" behavioral niches on cognitive performance (in neurotypicals and autistics).
Results: Â From both an explanatory and an ethical perspective, the key result of this study is that the model of "niche construction" is better able to accommodate the agency of individuals in their ongoing and dynamic shaping of their environmental affordances. This helps to clarify the nature of ethical responsibilities in cases of ASD in a way that previous models (such as the "social model of disability" or radical forms of relativism) have not been able to do, in particular by integrating agentic and situational aspects of an individual's ability to meet context specific demands for social communication and social interaction.
Conclusions:Â These results also serve to help orient new empirical and theoretical research in autism into the ways in which individuals with autism and caregivers intentionally or unconsciously construct the niches in which they must function.
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182 **180.182** The Meaning of the Diagnosis of Autism for Adults. a Phenomenological Study

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Background: Autism and ASD (autism spectrum disorder) are concepts that cover many realities and that have different meanings for different people. For many people, autism as a term refers *to a specific neurological and biological reality.* Also, the idea of autism as *a genetic* condition has gained popularity over the last years, and a large part of the research is done in this field. Much less is known about what *it means to have a diagnosis of autism* for the person herself. Indeed, although recently more attention has been paid to the values and opinions of people with a diagnosis of ASD with regards to research aims etc, very little research has been done on the meaning of such a label for the individual.
Objectives: With this study, we wanted to investigate what it means to have a diagnosis of autism in adulthood for the individual in question, using a phenomenological approach.
Methods: In the period from June 2016 till August 2016 we have performed in-depth interviews with 22 adults in Belgium and The Netherlands (aged 24-60) with a diagnosis of ASD. We used a phenomenological interview method, which means we have set aside our assumptions about what autism *is*, and we assume that the lived reality of having a diagnosis is an equally important source of information. Respondents had the opportunity to choose an oral interview, or chat sessions, in order to accommodate for those who feel uncomfortable with the former. The interviews were analyzed using a thematic inductive analysis. Interviews and analysis were done by the main researcher and a co-researcher who had received a diagnosis of Asperger syndrome in adulthood. This allowed for different perspectives on the data to be incorporated in the analysis.
Results: Â On the one hand, our respondents welcomed their diagnosis as a scientific and 'brain-based' explanation for difficulties they experienced in their lives. An experience all our respondents shared was that of heightened sensorial awareness. On the other hand, they struggled with the question how to integrate their diagnosis with their personal feeling of "self". Specifically they questioned or even opposed stereotypes about autism, for example by referring to the fact that they do experience empathy. Moreover, many struggled with finding adequate help and assistance after the diagnosis: help was either nonexistent or not tailored to the specific needs of the individual, and/or based on general assumptions about what is autism.
Conclusions: Â An autism diagnosis in adulthood can be conceived as a "walking cane": respondents appreciated the explanatory power of the diagnosis, and considered this a necessary first step in their therapeutic process. How the diagnosis would actually help them therapeutically was far less clear. With this study we hope to demonstrate that input from those diagnosed with autism is an essential part in improving the therapeutic process.

183 **180.183** Predictors of Well-Being Among Mothers of Children with Autism in Lebanon

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Background:
This study extends upon our work demonstrating that heightened child behavioral problems were associated with poorer well-being among mothers of children with ASD in Lebanon (Obeid & Daou, 2015). Mothers' coping styles (Benson, 2010) were also associated with well-being; distraction and disengagement were associated with poorer well-being, while cognitive reframing predicted enhanced well-being. Unlike Benson's (2010) finding in the U.S., engagement was *not* associated with maternal well-being in Lebanon. Lebanese mothers reported using more problem-focused than emotion-focused coping, which we believed might be due to the social desirability bias.
We controlled for social desirability; compared benefits of formal and informal social support; and examined the impact of additional factors on well-being: (i) knowledge, given that trainings about ASD enhance knowledge (Gillespie-Lynch et al., 2015) and that Kuhn and Carter (2006) suggested knowledge could facilitate maternal self-efficacy and well-being despite limitations they noted in their knowledge measure; (ii) empowerment, given that parents' understanding of ASD empowers them to improve their children's quality of life (Murray et al., 2011); and (iii) locus of control (LoC), given that prior research (Siman-Tov & Kaniel, 2011) showed that parents with internal LoC cope better with stress than those with external LoC.
Objectives:
(1) To examine if baseline child behavioral problems and maternal coping styles, LoC, autism knowledge, empowerment, and formal and informal social support impacted maternal well-being after controlling for social desirability. (2) To examine if participating in an in-person training about ASD was associated with increased ASD knowledge and maternal well-being.
Methods:
A within-subject quasi-experimental design assessed whether the training was associated with changes in well-being. Participants completed a pre-test, an hour-long lecture-based training about ASD, and a post-test. The training, a 63-slide presentation adapted from Gillespie-Lynch et al. (2015), described ASD and effective tools/interventions, during group sessions. Fifty-four mothers completed the pretest, 33 also completed the training and post-test. Measures assessed behavioral problems, coping styles, ASD knowledge, social support, empowerment, LoC, social-desirability bias, and well-being. The reliability of the ASD knowledge scale (α= .47) was lower than in our work with students and teachers in Lebanon (αs> .61).
Results:
LoC and distraction were significant predictors of maternal well-being, $F(2,49)= 6.72$, $p= .003$. The model explained 21.5% ($R^2= .215$) of the variance in maternal well-being. We found no evidence that the training enhanced ASD knowledge, empowerment, and maternal well-being from pretest to posttest.
Conclusions: Distraction coping and LoC predicted maternal well-being. However, the ASD knowledge measure had lower reliability than in other samples and the intervention was not impactful. Mothers were more knowledgeable about autism than teachers in Lebanon in our concurrent work, likely due to their lived experiences with their children. Deeply rooted experiences may have contributed to low reliability and to difficulty shifting conceptions. It is critical to attune assessments and interventions to the needs of mothers, particularly where resources are scarce (e.g., Harrison et al., 2014). Adopting a bottom-up approach by conducting needs assessments and developing trainings/instruments that address them may be more effective.

184 **180.184** The Status of EARLY Identification of Autism in Brazil

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Background:
Parents seems to perceive that their ASD child´s development is not following the typical pattern as early as in the child first year of life. However, ASD children may not be diagnosed until they are of school age, especially in low and middle-income countries (LMIC).
Parents seems to perceive that their ASD child´s development is not following the typical pattern as early as in the child first year of life. However, ASD children may not be diagnosed until they are of school age, especially in low and middle-income countries (LMIC).
Objectives: To describe the status of ASD early identification in São Paulo, Brazil.
Methods: this cross-sectional study has been conducted in five Psychosocial Community Care Centers for Children and Adolescents (CAPSI), the public services responsible to treat ASD youth in the Brazilian Unified National Health System. In São Paulo city, there are 25 CAPSI, organized into 5 regions. The selection strategy was: firstly, we randomly selected one unit per region, and then all mothers/caretaker of ASD youth were face-to-face individually interviewed. Participants: 196 mothers/caretaker of children diagnosed with ASD in the last 10 years. Instruments: An adapted version of David Mandell's questionnaire about the parental early concerns, that took an average of 45 minutes to be completed (Mandell et al., 2005). This study was approved by the Brazilian ResearchÂ *Ethics Committee.Â*
Results:
mean age of ASD youth was 8.5 years old and age range: 3-21 years old; 80.6% were boys and 79% had language delays. Overall, mothers had their first concerns that their child's development was atypical when children were 25.6 months old (SD± 19; range: 2-144 months old), but these children had a formal diagnosis of ASD only at a mean age of 60 age (SD±2.7) (age range 12-180 months old), resulting in an average delay of 34.4 months in diagnosis. The vast majority of mothers mentioned their concerns firstly to pediatricians (65.3%), while 13.0% of them sought for specialists, mainly neuropediatrician or child psychiatrist. We also asked mothers to recall their first concerns about their child development. Interestingly, these concerns were not related to the core symptoms of autism, such as agitation, hyperactivity and temperament patterns.
Conclusions:
This is the first study presenting data about age of first symptoms noticed by parents and age of formal diagnosis in Brazil. The mean age of parents early concerns in Brazil was slightly higher than those in LMIC, while the age of ASD diagnosis was similar. The delay for diagnosis was almost of 3 years, which is a public health concern. In Brazil, Pediatrician is the first professional that mother seek for help, therefore specialized training in ASD would help them to better identify cases.

185 **180.185** A Proposed Measurement Solution to Psychometric Concerns with Existing ASD Knowledge Assessment Tools

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Background:
ASD knowledge deficits contribute to current disparities in the timing and quality of ASD services throughout the United States and globally (Khan et al., 2012; Magaña, Lopez, Aguinaga, & Morton, 2013). We will present a systematic review of the literature to examine measures used to assess ASD knowledge (Harrison et al., in press). This review examined the psychometric strength of 44 unique ASD knowledge measures across 67 studies conducted in 21 countries. Of the 67 studies reviewed, only 7% were rated as using a measure with strong psychometric support compared to 45% that were rated as using a measure with no reported psychometric support. Additionally, we will describe a tendency to examine a unitary assessment of ASD knowledge rather than thoroughly assessing subdomains of ASD knowledge content overlap and subdomains of ASD knowledge assessed (e.g., etiology, symptoms) and a failure to design measures compatible for cross-cultural research.
Objectives: We will present a subsequent study that arose following this review, in which we developed the Autism Stigma and Knowledge Questionnaire (ASK-Q) with the goal of providing a measure with strong psychometric support, cross-cultural utility, and that comprehensively assesses the multiple subdomains of ASD knowledge.
Methods:
We will describe the measurement development process including the collection of validity data. The ASK-Q has a proposed 4 factor structure including three subscales assessing specific components of ASD knowledge (diagnosis, etiology, and treatment), and a fourth domain assessing the endorsement of stigma. 149 items derived from derived from a pool of pre-existing items drawn from previously published peer-reviewed research were evaluated by a group of 16 international researchers representing 11 countries (US, UK, Iran, India, Saudi Arabia, Malaysia, Tanzania, Senegal, Cape Verde, Zambia, and Burkina Faso). Researchers rated the face, construct, and cross-cultural validity of each item using a Likert scale.
Results:
Of the total 47 items selected from the item pool for inclusion in the ASK-Q, 17 items were categorized into the symptom subscale (item mean range: 3.6 - 4.0), 16 in the etiology subscale (item mean range 3.31 - 3.63), and 14 items in the treatment subscale (item mean range 3.38 - 4.0). Ratings revealed that 7 of these knowledge items would also load on to a factor assessing the endorsement of ASD stigmas (item mean range from 3.62 - 3.89). Three researchers reviewed the remaining items to ensure that each had a clear true or false answer. Additionally, item content was reviewed to minimize repetition and to ensure that each subdomain covered a range of topics. Reponses on the ASK-Q collected from a large sample of college students and the general public (n = 617) allowed for an examination of the proposed four factor structure. Using a newer form of psychometric analysis called Diagnostic Classification Modeling we confirmed the factor structure and evaluated the statistical validity of each item among a lay sample of n = 617.
Conclusions:
The resulting measure will allow for a more valid and reliable measure of multiple domains of ASD knowledge and stigma endorsement across cross-cultural settings.

186 **180.186** Using a Simple Social Communication Chart to Work with Parents

***N. Gaddour**, University Hospital F. Bourguiba, Monastir, TUNISIA*

Background: Tunisian and African context in general are marked by a shortage of human and technical resources to deliver structured and intensive interventions to the fast growing number of children diagnosed with ASD. The race to meet theoretical standards of effective care, such as stated in manualized interventions, seems useless. Hence the importance of simpler interventions using available resources, mainly parents.
Objectives: to design a simple tool for the follow-up of interventions coordinated with parents and educators
Methods: Compilation of literature on social communication development milestones and different interventions (behavioural, developmental) to foster their acquisition, confronted to clinical practice with more than 1000 children with ASD and their families.
Results: the social communication chart is a simple grid in three segments:

1. Basics of communication: eye contact, joint attention, motor imitation, vocal imitation, receptive language, proto-imperative gestures.
2. Symbolic communication: pretend play, sharing experiences, proto-declarative gestures, expressive language
3. Social communication: narrative skills, social rules, theory of mind, pragmatic language.

It was used with more than 200 children and their caregivers and led to more involvement of parents. Each acquisition was explained with appropriate actions proposed to parents as “homework” and checked and rated at follow-up sessions (videos)
Conclusions: Â In our experience, practical and simple actions, proposed by clinicians with a minimal level of structuration, and applied by parents and educators under supervision, can lead to robust improvements for children with ASD.

187 **180.187** Autism in Africa: Community Perception, Implication for Social Development and Learning in Childhood

***M. O. Bakare**, Federal Neuro-Psychiatric Hospital, Upper Chime, New Haven, Enugu, Enugu State, Nigeria, Enugu, NIGERIA*

Background:
The paucity of data on Autism Spectrum Disorder in Africa has lead erroneously to the thought that the disorder is uncommon in Africans and may be a problem of the western population. Hence, only severe cases with marked disruption in behavior are viewed as a disorder in Africa, with milder cases probably considered as normal.
Objectives: Â The emerging interest in the field of Autism in Africa provides an excellent opportunity to review the community perception of the disorder; it’s implication for social development and learning in childhood.
Methods: Â Existing literatures in Africa on community perception of ASD were reviewed.
Results: The age of onset of Autism in Africa tends to coincide with the period of vulnerability to other physical ailments with neurological complications under the age of five years. Hence, high co-morbidity of other neurological complications in cases seen in Africa. There are no known local words to express Autism in most African languages and the disorder is still being considered to be of supernatural causations. This further encourages stigma to the family members which results in late presentation. Review of previous studies in Nigeria shows that among health workers, a small percentage views autism as treatable while few others see it as being preventable. Community perception of autism in Africa has a wide range of implications which include; poor understanding of the disorder, increased stigmatization, social exclusion and lack of appropriate policies by the authorities to improve care and promote community inclusion.
Conclusions: Increased awareness about the disorder would promote early detection, reduced stigma and promote social inclusion.

188 **180.188** Challenges and Innovation in Autism Research Approaches in South Africa

***M. Hoogenhout** and N. M. Ing, Department of Psychology, University of Cape Town, Cape Town, South Africa*

Background: Autism research in South Africa faces daunting obstacles, including lack of prevalence data for autism and other developmental disorders, and lack of funding for chronic, non-communicable diseases that do not directly lead to child mortality. Potential participant cohorts are often not well identified, are dispersed over a large geographical area, and are linguistically and culturally diverse. This challenging context calls for adaptations to the traditional research methods and processes used in the Global North.
Objectives: This presentation will discuss the challenges to expanding autism research within South Africa, as well as the promise that research on this multilingual, multicultural and genetically-diverse, yet understudied, autism population holds.
Methods: The presentation will draw on cognitive, survey, and behavioural data collected by the Autism Research Group at the University of Cape Town, South Africa. The authors will also describe the process of starting autism research within a middle-income African country, and offer insight into the success and pitfalls of this process.
Results: In South Africa, children are diagnosed with autism fairly late in childhood, creating challenges in identifying participants for studies on early identifiers or mechanisms in ASD, as well as studies on early intervention. Encouragingly, research on existing screening and diagnostic tools tentatively show that several of these tools are reliable for use in South African population groups. Use of these tools, as well as increasing awareness of autism generated by ongoing research studies, promises to steadily lower the age of diagnosis. An advantage to research recruitment of children with ASD in South Africa is that many school-age children are in autism-specific schools, which facilitates identification of potential participants. Regarding studies of biopsychosocial pathways in autism, the use of techniques such as magnetic resonance imaging is limited by the cost and availability of equipment and local expertise. However, lower-cost, portable devices to measure peripheral physiological processes are ideal for use in studies with limited funds or where participants are spread over vast areas. Cognitive and diagnostic-observational research are challenged by lack of data on the validity and reliability of the use of standardised tests developed in the Global North in a multilingual and multicultural society such as South Africa. In this area, the field is open for more international collaborations on the development of culturally-unbiased and low-cost or free assessment tools. In the area of intervention research, community-based interventions are more likely to be sustainable in the long term than one-on-one interventions. Inclusion of families and other stakeholders in developing research priorities and developing or adapting interventions are crucial.
Conclusions: Africa has much to offer autism research. The diverse nature of the South African population holds great promise for better describing the complex genetic, molecular, physiological and behavioural presentation(s) of autism. It is hoped that our experiences – successes and pitfalls - in expanding autism research at the University of Cape Town fosters increased autism research in Africa.

189 **180.189** Caregivers' Distress and Care Support Among Caregivers of Patients with Autism in a West Africa Community Surveillance

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Background:
Autism is a neurodevelopmental disorder with poor diagnostic coverage in developing world. In Nigeria, most of the subjects have had psychiatric diagnosis other than Autism or an Autistic Spectrum Disorder (ASD) at some point in time, resulting in significantly negative impact on their care and outcome. Parents/caregivers of these subjects may therefore experience frustration while in search for diagnosis, care and support. These experiences affect different facets of their lives.
There is a large gap in the services for these subjects and caregivers. Many fund the care of the subjects by out of pocket expenditure, while others rely on family members and communities for support.
Objectives:
The study aims to determine the distress experienced by caregivers of patients diagnosed and their social support.
Methods:
Subjects were recruited from an autism awareness programme through one-on-one consultation. A sociodemographic questionnairewas administered to all consenting participants following which they were screened using, Modified Check list for Autism in Toddlers (MCHAT) for children aged 3years and younger and Childhood Autism Spectrum Test (CAST) for those older than 3 years of age. Diagnosis of ASD was made based on DSM 5 criteria for autistic spectrum disorder.The perceived social support scale was used to assess the level of social support.
Results:
A hundred and one subjects (101) out of a total of 276 people with neurodevelopmental disorders met the DSM 5 clinical diagnosis of ASD, Fifty eight (57.4%) met a diagnosis of ASD by screening with CAST and MCHAT - 74% by CAST and only 4.2% using MCHAT. Majority of the subjects (82.2%) were males and about a third (32.7%) are less than 5years. More than three quarters (79.2%) are schooling with about two thirds (65.9%) in regular schools.
Only a tenth (10%) of the caregivers belong to a self help group, caring for the subjects had impacted negatively on the relationship of 9% of the caregivers with their spouses, more than 3 quarter (76.8%) of the respondents reported that the care of the subjects had affected their finances, a third of them (32.4%) have people other than the spouses supporting them but area of support or type was not mentioned.
Some (15.5%) had been blaming themselves for the cause of the subjects problem, 9% of the caregivers said they are ashamed to be with the subjects while 4 of them had been contemplating suicide. Less than a fifth (19.4%) had low social support while 37.3% of them reported high level of support.
Conclusions: Caregivers of patients with ASD experience distress in caring for their wards but seem to have a good support system despite for the lack of a structured system of support in our environment. There is a need for to strengthen the support for these caregivers so as to help in alleviating their distress.

190 **180.190** Systems of Service Delivery for Care of Indian Children with Autism Spectrum Disorders

S. M. Kaku*, Clinical Neurosciences and Child and Adolescent Psychiatry, National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore, India*

Background: India has the second largest population in the world. Till date there is no national data which reports the prevalence of ASD in India. However, there are a number of service providers like special educators, speech therapists, occupational therapists, psychologists and psychiatrists catering to the needs of the families. In this complex system of service delivery, parents often see multiple professionals, have to move across the country for consultation and sometimes when living in resource limited areas, have difficulty to access regular help, resulting in the need to deliver home based training programs for their children with ASD.
Objectives: This study aims to describe the current available pathways to care in India.
Methods: Review of literature published in India from centres managing children with ASD was reviewed. Retrospective and prospective data from our centre was reviewed. Various steps in the pathway to care were examined which included the diagnosis, assessment and management components.
Results: While most studies seem to find that symptoms are first detected by 12 to 18 months of age, the first contact is much later as parents would "wait and watch" for children to gain milestones. Very few parents have access to trained child mental health professionals across the country and if they do, they come for a single visit consultation due to financial burden. When they initiate consultation, the first contact person for 60% of families was a Pediatrician. Neurologist (11%) and speech therapist (11%) were the next preferred specialists whom family consulted initially; followed by ENT surgeons, psychiatrists, child and adolescent psychiatrist, psychologists and others. Parents consulted an average of 3.2 doctors (Range: 1-10) before receiving a diagnosis of ASD. Many families would not come to consult in academic institutes due to long waiting hours for consultation and would prefer smaller centers run by trusts, non-governmental organizations and private practitioners. Assessments would be done by professionals systematically; however, families were not adequately satisfied about the intervention methods advised. The need for multidisciplinary inputs and resource limitation brings in enormous pressure on the families who then practice home based intervention methods. Education system is supportive to children with special needs with the government following inclusive education. There are currently very few government funded ASD research programs across the country.
Conclusions: Though awareness about ASD is good, lack of resources makes it a challenge to practice good service delivery. There is need to improvise public programs, promote awareness, advocate the importance of early intervention for children with ASD and provide well integrated and organized pathways to care.

191 **180.191** ASD Service Delivery in South Africa

***N. M. Ing**, M. Hoogenhout, S. Malcolm-Smith and K. Thomas, Department of Psychology, University of Cape Town, Cape Town, South Africa*

Background:
The availability of Autism Spectrum Disorder (ASD) services in low-middle income countries (LAMICs) is poorly documented. Typically, research has focused on high-income countries (HICs) from the global north with a lack of research focusing on LAMICs, like South Africa. This situation is problematic given the likelihood that individuals in LAMICs might, for instance, face comparatively heavy socioeconomic burdens, and that healthcare systems in those countries might bear comparatively heavy burdens of disease. Thus, data from HICs regarding service delivery and quality of life in ASD may not be useful in the LAMIC context. Within South Africa, as in much of Africa, there is no published research concerning service delivery. The lack of service delivery data makes identifying the shortfalls of the services challenging, and hinders calls for improved ASD care in South Africa.
Objectives:
This study addressed the paucity of information on care pathways in LAMICs by examining parents' perspectives of ASD service delivery adequacy and availability.
Methods:
We recruited two hundred parents of ASD children and adults, from various sociodemographic and cultural backgrounds from three different provinces within South Africa. A detailed service delivery questionnaire was administered with each parent. Additionally, six parent focus groups were held to obtain in-depth perspectives on service delivery obstacles and strengths. Various areas of service delivery were examined, including the diagnostic process, current health care, access to and quality of education, and the impact of the ASD diagnosis on the family.
Results:
The majority of children were typically diagnosed later (i.e., after 2 years old) than the age parents first noticed behavioural and developmental difficulties (age = 26 months). Overall, most of the children were diagnosed before 6 years old. Furthermore, some families had to consult multiple professionals before receiving a diagnosis, with most of the families reporting that ASD was not mentioned at their first consultation with the professional. However, most of the parents reported receiving referrals to various services while waiting for the diagnostic assessment. A range of different therapies/interventions were utilised, with speech therapy being the most common. School attendance was predominantly in autism-specific schools, followed by public special needs schools. Furthermore, most parents reported that their child does not receive interventions or any form of therapy at their school. Additionally, most parents reported a lack of, and in turn a need for, community-funded therapies, community organisations, and career and employment assistance for autistic adults. Families reported that their child's ASD diagnosis negatively impacted their financial situation and for some their ability to maintain employment. Additionally, only 28% of parents reported receiving government assistance. Other challenges included services being expensive and far from the parent's home, as well as long waiting lists for services.
Conclusions:
This study provides key information regarding the limitations of the services provided to individuals with ASD and their families within a LAMIC context. It highlights the need for better integration of services, earlier identification and treatment of ASD in South Africa, and greater financial, social and educational support for families.

Poster Session
181 - Interventions - Non-pharmacologic - School-Age, Adolescent, Adult
12:00 PM - 1:40 PM - Golden Gate Ballroom

192 **181.192** A 6-Month Follow-up of a Daily Living Skills Intervention for High Functioning Adolescents with ASD

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Background: Â Adolescence is a time of critical milestones, and those with autism spectrum disorder (ASD), even those who are high functioning (IQ >70), have difficulties successfully transitioning to the adult world in areas such as independent living and employment (Hume et al., 2014). In one study, 46% of parents reported that adults with high functioning ASD required “extensive help” completing activities of daily living, which impacted their ability to maintain employment (Farley et al., 2009). Daily living skills are everyday activities such as personal hygiene, cooking, cleaning, and managing money. Daily living skills were the only significant factor that predicted a positive outcome in adulthood for individuals with ASD, and have been linked to a more successful outcome in college, employment, and independent livingÂ (e.g., Klinger et al., 2015). Despite their importance, the daily living skills of adolescents with high functioning ASD fall far below what would be expected based on their IQ and chronological age (Duncan & Bishop, 2015). While daily living skills can be taught using empirically-based strategies, there are no evidence based intervention packages that target the acquisition of daily living skills in adolescents with high functioning ASD. We recently completed a pre-post trial to evaluate the efficacy of an intervention package, Surviving and Thriving in the Real World (STRW), which targeted increasing critical daily living skills in adolescents with high functioning ASD. Results revealed that all 7 adolescent participants with ASD gained an average of 2-2.5 years, as measured by Vineland-II Daily Living Skills domain age equivalent scores, over the course of the 12-week intervention. Adolescent participants also made significant progress, as assessed by goal attainment scaling, in all targeted areas of the STRW intervention.
Objectives: The primary aim of the current study was to evaluate the sustainability of STRW by assessing primary outcome measures (i.e., Vineland-II Daily Living Skills domain and subdomains, goal attainment scaling) at a 6-month follow-up assessment.
Methods: The pre-post trial consisted of 7 adolescents with ASD between 14-18 years and their parents. All participants had IQs>70 and met criteria for ASD on the ADOS-2. Information on daily living skills was collected using (1) the Vineland Adaptive Behavior Scales, 2nd Edition and (2) a goal attainment scale that was created for each adolescent from a parent interview that assessed skills in the goals targeted in the STRW intervention. STRW consists of 12 group sessions with adolescents and their parents that targets skills in the areas of hygiene, cooking, laundry, and money management. Daily living skills were re-evaluated 6 months after completion of STRW.
Results: The 6-month follow-up assessment of STRW is currently being conducted and will be completed by October 2016. Statistical analyses will be conducted to examine primary outcomes.
Conclusions: The current study will assist in determining whether critical daily living skills are sustained and further developed after completion of a daily living skills intervention for high functioning adolescents with ASD. A daily living skills intervention has the potential to directly affect current functioning and future adult outcomes in adolescents with high functioning ASD.

193 **181.193** A Cross-Regional and Multidisciplinary Delphi Consensus Study Describing Usual Care for Anxiety Problems in School to Transition-Age Youth with Autism

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Background:
Strides have been made in recent years to develop evidence-based practices (EBPs) for core social and highly prevalent comorbid conditions, such as anxiety disorders, in youth with ASD. A critical step to successfully implementing such EBPs is to develop a greater understanding of what comprises usual care for youth with ASD in community settings. Yet, even developing an understanding of the landscape of usual care services is complicated by the lack of a common, inclusive vocabulary and catalog of intervention strategies with which to survey the diverse range of professional disciplines that serve youth with ASD.
Objectives:
This study aimed to develop consensus among experts from multiple disciplines and regions in the U.S. regarding the intervention strategies most familiar to providers serving youth (7-22 years) with ASD, and those considered most useful, commonly-used, and research-supported to address anxiety in this population.
Methods:
Using an online Delphi technique (Hsu, 2007; Bishop et al., 2016),Â snowball sampling was used to recruit a panel of 66 expert ASD providers (i.e., primarily served youth with ASD for >5 years and served >50 ASD individuals) representing multiple disciplines (education, psychology, psychiatry, behavior analysis, social work) from 5 sites (Philadelphia, Chicago, New York City, San Diego, Long Island). Round 1 began with a set of 50 intervention strategies (with descriptive examples) derived from a systematic review of the literature. Participants rated their familiarity with each strategy on a 4-point scale (“not at all” to “very”), added free text comments and suggested additional strategies not represented in the list. Familiar strategies were also rated on the same 4-point scale for: frequency of use, usefulness, and empirical support for reducing anxiety in ASD (ratings for other presenting problems were also collected but our analyses will focus on anxiety). Round 1 responses were synthesized by the research team, who then removed, combined, modified and added items to facilitate consensus. The revised list of strategies was returned to the panel for a second evaluation. Eighty percent of the initial sample completed the revised survey.
Results:
Composite results yielded a list of 56 intervention strategies, 48 of which were familiar/very familiar to >75% of the sample. Of these common strategies, consensus was also established around those most often used (16 strategies >75%), most useful (33 strategies at >75%), and most research supported (8 strategies > 75%) to treat anxiety in ASD. In general, agreement regarding the usefulness of a strategy did not always correspond to beliefs about how often that strategy was used or research supported (Table 1).
Conclusions:
Delphi methodology was used to achieve consensus among expert ASD providers from multiple disciplines and locales regarding the intervention strategies used to support youth with ASD and co-occurring anxiety. Consensus ratings also suggest variability in the perceived usefulness, use and research support for these strategies as treatments for anxiety by expert providers. These findings may support a “two-way” bridge of communication, wherein knowledge from both providers and from clinical research is integrated to identify and disseminate effective interventions.

194 **181.194** A Modified Book Reading Intervention for Students with Complex Communication Needs Who Are English Learners and Have a Severe Intellectual Delay

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Background: Reading comprehension is an important skill for individuals with autism to learn. The research in this area has increased but is still lacking in the area of individuals with ASD that have Complex Communication Needs and are English Learners. This study examined using modified books and a bilingual intervention package to increase reading comprehension.
Objectives: The goal of the study was to determine if the intervention package was successful and if an intervention given to an English Learner bilingually would increase reading comprehension. The researcher measured if the participants answered comprehension questions, if they answered them with accuracy and if they had an increase in independent communication, separate from the reading comprehension questions being asked of them.
Methods: An alternating treatment design was used in which participants received the intervention package in English on one day and on a different day received the intervention package Bilingually.
Results: All students demonstrated an increase in independent communication attempts during
the intervention phase. There were no systematic differences between
bilingual or English-only conditions on child outcome measures.
Conclusions: The results did not show any difference in the measures on the English day compared to the Bilingual intervention day. However, there is still very little research in this area. More research needs to be conducted in this area to determine best practices for students with Autism who are English Learners and have Complex Communication Needs.

195 **181.195** A Multiple Single Case and Mixed-Methods Evaluation of a Parent-Mediated CBT Intervention for Children with ASD and Difficulties with Emotional Regulation: Feasibility, Acceptability and an Initial Estimate of Efficacy

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Background: Â In addition to the core deficits, many young people with Autism Spectrum Disorder (YPASD) have difficulties with emotional regulation which can present as elevated levels of anger and aggression. Such problems left untreated can disrupt the child's psychosocial development and have a longstanding and negative impact on the child and their family. However, in comparison to anxiety management, there is a paucity of research on therapeutic interventions for anger management in this population. Furthermore, there has been no research on individually administered CBT for anger management for YPASD.
Objectives: Â The aim of this study was to obtain an initial estimate of efficacy and investigate the acceptability and feasibility of an individually administered, parent-mediated cognitive behavioural intervention for YPASD (8-14 years old) with emotional regulation difficulties relating to anger.
Methods: Â The study employed a mixed-methods, small-N design which consisted of a series of seven systematic case studies. Participants acted as their own controls. Frequency data was collected fortnightly over a baseline period, during the intervention period and atÂ six week follow-up. The primary outcome measure was a parent report frequency measure of anger outbursts. Secondary outcome measures included the Strengths and Difficulties Questionnaire, the Parenting Stress Index– Short Form, personalised Goal Based Outcomes and post-intervention interviews. Visual analysis of the primary outcome was supplemented by a Tau-U statistical analysis (Parker, Vannest, Davis & Sauber, 2011). The reliable change index (Jacobson and Truax, 1991) was used to calculate reliable differences of pre/post data of the secondary outcome questionnaires. Qualitative interview data were analysed using thematic analysis (Braun and Clarke, 2006).
Results: Â The quantitative and qualitative results indicated preliminary evidence that the intervention was acceptable to most families. Analysis revealed that the intervention led to statistically significant reductions in anger outbursts in two cases. Parents also reported additional improvements to the intensity and duration of outbursts which were not captured by the frequency measure. Qualitative data also revealed other positive child behaviour changes as well as positive changes in parental stress and improved communication between parents and child. The outcome varied across participants which suggests there is a need to better understand how such interventions can be modified to benefit a greater proportion of individuals. Obstacles to progress highlighted through post-intervention interviews with parents and therapist checklists related to the young person's motivation to change, their ability to generalize skills outside sessions and underlying anxiety.
Conclusions: Â Our findings provide preliminary evidence that an individually administered CBT intervention is acceptable and can lead to a number of positive outcomes for families of YPASD. Some obstacles to progress were highlighted by qualitative feedback and this data suggests ways in which CBT interventions could be improved for this population. Overall, the findings support further investigation of a refined version of the intervention through a larger, controlled study.

196 **181.196** A Review of Social Communication Interventions for Students with Autism Spectrum Disorder in School Settings: Contributions from Single-Subject Research

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Background: Poor social communication skills are one of the many barriers that hinder the ability of students with ASD to learn and interact with peers in school settings. Studies evaluating the efficacy of interventions that promote the acquisition and the development of different social communication skills for children with ASD have been reported in the literature and reviews for such a literature have been conducted. However, none of the previously conducted reviews explicitly evaluated single-subject research targeting social communication skills for students with ASD in school settings.
Objectives: The purpose of this study to systematically review peer-reviewed publications that utilized single-subject experimental design to evaluate interventions targeting social communication skills for students with ASD (3 to 21 year old) in school settings.
Methods: Sixty-nine studies, located in ERIC, PschINFO, and MEDLINE and published from 1995 to 2014, met the inclusion criteria. These study were sorted by: 1) the number and the characteristics of participants, 2) settings, 3) targeted outcome(s), 4) intervention practice used, 5) type of single-subject design, 6) documentation of generalization and maintenance, 7) the person delivering the intervention, 8) the rigor of the study (Reichow et al., 2008), and 9) effect size using non-overlap indices Tau-U score (Parker et al., 2011). Inter-rater reliability for coding was 97.91%.
Results: One hundred and ninety two students (150 male, majority of them were between 3-6 years old and elementary school age) with ASD diagnoses were exposed to intervention and intervention packages (mostly based on behavioral principles) targeting social communication skills that were delivered by teachers, researchers, peers in 29, 36 and 8 studies, respectively. The targeted social communication skills were categorized in two ways: 1) based on the function, type, domains of skills, and 2) based on the form and/or the modality of the outcomes. Requesting, joint attention, conversation-related skills, greeting, and commenting were targeted in 39, seven, seven, four , and 12 studies respectively. Ten studies targeted skills were not part of the above-mentioned categories. With respect to the form or modality of skills targeted, verbal responses were targeted in 44 studies and nonverbal responses (e.g., gestures such as pointing, reaching, showing, eye contact, or eye gaze, etc.) were targeted in 20 studies, manual signs were targeted in two studies, picture exchange were targeted in 14 studies, the use of speech-generated devices (SGD) was targeted in 15 studies. In terms of the rigor of the study, only seven studies were rated as strong, 39 were as adequate, and the remaining 23 as weak. The mean Tau-U across all the studies was 0.76 (range from 0.00 to 1.00).
Conclusions: Findings from this review suggest the availability of a wide range of specific interventions (and intervention packages) to improve different social communication skills for students with ASD in school settings.

197 **181.197** A Thematically Structured Educational Program for Children with Autism Spectrum Disorder

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Background: **: Limited studies have been conducted to test the effects of an inclusive educational program that aims to adress multiple skills of children with ASD. Most of the ASD intervention studies have focused on a specific ability group (e.g., low-functioning, high-functioning). Yet, there is a limited research efforts on the programs that can accommoate children with ASD across various abilities. A thematically structured eduactional program was created to address the needs of children with ASD. This program was designed to teach multiple skills to children with ASD and their peers with TD.**
Objectives: **This study was conducted to examine the prelimiary effects of this educational program on social and communicatino skills of children with ASD.**
Methods: **A quasi-experimental pre-test/post-test intervention group vs. waitlist control group design was used. Fifth-six children (46 males; 10 females) with an ASD between the ages of 3 and 12 years participated in this study. The inclusion criteria for children with ASD in this study included: (a) the child had a clinical diagnosis of pervasive developmental disorder, autistic disorder, Asperger's disorder, or pervasive developmental disorder-not otherwise specified (PDD-NOS); (b) the child was between the ages of 3 and 12 years; and (c) the child's score on the Childhood Autism Rating Scale, Second Edition (CARS-2) was ≥ 30. This thematically structured educational program consisted of ten 120-minutes sessions and it was delivered once a week over the course of 10-weeks. Each intervention session was led by one theme and composed of four 30-minutes sequential segments: (a) dance party, (b) an interactive story, (c) language arts/math/science, and (d) arts projects. A curriculum detailed teaching activities was developed for each session and teachers in the program were trained to use the curriculum.**
Results: **Mann-Whitney U tests were used to determine the differences between the intervention group and the control group in the improvements in communication and social interaction. The results of Mann-Whitney U tests showed that (a) communication skills improvements as measured by Expressive One-Word Picture Vocabulary Test-Fourth Edition (EOWPVT-4; Martin & Brownell, 2011a), Receptive One-Word Picture Vocabulary Test-Fourth Edition (ROWPVT-4; Martin & Brownell, 2011b), and Vineland Adaptive Behavior Scales, Second Edition-Parent/Caregiver Rating Form (VABS-II-Parent/Caregiver; Sparrow, Cicchetti, & Balla, 2005)communication in the intervention group were significantly greater than those in the control group (EOWPVT: *Z* = 2.84, *p* < .01; ROWPVT: *Z* = 3.92, *p* < .001; Vineland-II communication: Z = 3.22, *p* < .001); (b) social interaction skills improvements as measured by Social Skills Rating System-Parent Form (SSRS-Parent; Gresham & Elliott, 1990) and Vineland-II socialization in the intervention group were significantly greater than those in the control group (SSRS-Parent: *Z* = 3.21, *p* < .001; Vineland-II socialization: *Z* = 3.66, *p* < .001).**
Conclusions: **This study found that the children with ASD who received this program showed significantly greater improvements in communication skills and social interaction skills than did the children who were in the waitlist control group. This educational program appears to hold promise in fostering the development of social interaction and communication skills of children with ASD.**

198 **181.198** ASD Students' Perceptions of the Optimal Practices That Aid Their Transition to Highschool

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Background: Many structural changes are associated with a transition to highschool, such as novel settings, curricula, peers and teachers. These changes may increase stress during this life period. In addition, students must cope with perbutal changes. Such a life period, which is considered difficult for most teenagers (Lohaus, Elben, Ball, & Klein-Hessing, 2004), can be even more challenging for students with an ASD (Hannah & Topping, 2012).
Objectives: The aim of this study is to identify the optimal practices that aid the transition to highschool according to students. This study also explores whether there is a significant difference between main stream students and ASD students in regards to such perceptions.

Methods: Forteen 6th graders integrated in regular classroom (2 girls and 10 boys) with ASD were selected to be part of group 1. Fourteen other main stream students were then matched to students from group 1 according to age and gender.
The participants were asked whether the intervention services highlighted in the scientific literature was helpful or not. A non-parametric test (McNemar) was designed to determine whether a change of binary state would yield statistical significance between both groups (p<0,05).
Results: There are no significant differences between the two groups. As there are no differences, the results will be specific to ASD students' perception. The most useful practice for students with ASD (n=13) in aiding their transition is to be informed about who their teachers will be. Also, 86 % (n=12) wish to : learn strategies to relax; to have a friend for dinnertime; to know where their locker is and how to open it; to have the opportunity to share their issues with an adult; to visit the school; and to know someone in their classes. Being informed on how much time they should devote to their homework and knowing emergency strategies was also deemed useful for 79 % (n=11) of the respondents. In addition, having a map of the school, a cellphone, a resource teacher, and a place where they can use their strategies with privacy was identified as helpful for 71 % (n=10) of students.
Conclusions: As there is no difference between the two groups, students with ASD in regular classroom should not be treated differently than their peers. However, specific attention should be paid to practices concerning the school setting. Indeed, visiting the school, having access to their future locker and meeting their future teachers should be methods adopted for every student. Also, the curricula and functional information of the school (homework, dinnertime, schedule, textbooks, remedial courses, etc.) should be presented to the future students. As shown by the results, students with ASD attending regular classes and following the regular program seem to cope well with their integration in the regular program.

199 **181.199** Acceptance and Commitment Therapy (ACT)-Based Stress Management for High-Functioning Autism Spectrum Disorder (ASD)

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Background: Autism spectrum disorder (ASD) is a neurodevelopmental disorder associated with depression, anxiety and stress, as well as decreased quality of life. ACT processes target core difficulties in ASD, such as psychological inflexibility, and has been shown efficient in reducing stress and psychological distress as well as increasing quality of life, although not yet evaluated for this population.
Objectives: To evaluate the efficacy and feasibility of an ACT-based stress management for adolescents and adults with high-functioning ASD.
Methods: Study 1:Â Using a quasi-experimental design we evaluated an adapted ACT-protocol for 28 students with ASD (aged 13–21).Â Study 2: Using an open trialÂ design the ACT treatment was evaluated for adults (n=10; age range 25-65 years) in anÂ outpatient psychiatric context.Â Study 3: Using an RCT designÂ we evaluated the ACT treatment for 40 adults with ASD in an outpatient psychiatric context.
Results: Study 1: Levels of stress, hyperactivity, and emotional distress were significantly reduced and pro-social behavior was increased. Study 2: Levels of stress were significantly reduced and quality of life increased. Study 3: Significantly reduced stress and psychiatric symptoms, and increased psychological flexibility and quality of life. Autistic core symptoms were also reduced.
Conclusions: The ACT-based stress management program may be an efficient and feasible option for adolescents and adults with high-functioning ASD in reducing stress, psychological distress such as depression and anxiety as well as increasing quality of life.

200 **181.200** Accommodating Adolescents with Severe ASD Symptoms in an Extracurricular Technology Club

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Background: Extracurricular clubs have been identified as natural opportunities for adolescents with Autism Spectrum Disorder (ASD) to gain support, practice social skills, explore topics of interest, and form relationships with peers that share those interests (Carter, Harvey, Taylor, & Gotham, 2013). Unfortunately, adolescents with severe ASD symptoms may be turned away from participation in extracurricular activities, as public schools are not required to provide aides for such programming. There is a need to develop a novel approach to include adolescents with ASD who are in effect barred from participating in school-sponsored after school extracurricular programs.
Objectives: The Computer and Technology (CAT) Club provided an engaging and supportive environment for adolescents with ASD to interact with typically developing peers with similar interests. Three of the participants had challenging behaviors that posed serious barriers to full inclusion. In depth case studies are reported to shed light on some potentially effective means of accommodating the unique needs of such adolescents who might still benefit from extracurricular programs when appropriate supports are provided.
Methods: The three participants selected for case studies were part of a larger study that included 11 individuals with ASD and 8 typically developing (TD) peers, ages 12-17, who expressed interest in technology. Participants were not labeled as having ASD, and social/vocational training was given to all participants regardless of diagnosis. Before the start of the club, participants took a test that assessed their knowledge of computer programming and robotics; they took the same test at the conclusion of the club in order to gauge any improvement in their knowledge. While all 19 participants were initially paired with similar aged peers to work as partners, it became evident that three of the participants could not work effectively with peers due to severe communication, social, or sensory problems. These participants were paired with trained volunteer college students who in effect served as one-on-one aides. The volunteers took daily notes; patterns from these notes comprise the data for the case studies. The notes consisted of open-ended narratives as well as answers to structured questions. Case study notes were analyzed both quantitatively and qualitatively in search of patterns of improvements in behavior and social skills that may suggest best ways to support individuals with extra challenges and unique needs.
Results: All three participants experienced significant gains in their knowledge of computer programming and robotics (see Table 1). Qualitative data will be analyzed and presented as case studies (see notes in Table 2).
Conclusions: Preliminary qualitative analysis shows improvement of social behavior and increased peer interaction. Furthermore, despite their challenging behaviors, all three of them made significant gains in their knowledge of technology which could be used to further their vocational options in the future. These results provide support for the benefits of involvement in extracurricular activities for adolescents with severe ASD symptoms and problem behaviors. The use of college student volunteers offers a cost effective solution when schools or parents cannot afford a one-on-one aide for this purpose.

201 **181.201** Adolescent and Parent Factors That Contribute to Non-Completion of the PEERS® Intervention

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Background: Although the Program for the Education and Enrichment of Relational Skills (PEERS®) has been shown to be well-accepted and feasible (Laugeson, Frankel, Gantman, Dillon, & Mogil, 2012), some adolescents are still prone to withdrawing from treatment. Little is known regarding factors that may interfere with social skills intervention success among adolescents with ASD (though factors predicting success have been examined; Chang et al., 2014).
Objectives: The primary objective of this study was to examine adolescent and parent factors thought to interfere with intervention completion. It was hypothesized that high levels of anxiety, depression, and arousal, and, conversely, low levels of problematic behaviors common to ASD on behalf of the adolescent, as well as parenting stress on behalf of the parent were likely predictors of withdrawal. Each of these factors was examined from data collected prior to the outset of the intervention.
Methods: One-hundred fifty-four adolescents with ASD (*N*=154) aged 11 to 16 participated in this study. The adolescents completed the Youth Self Report (YSR), Social Anxiety Scale for Adolescents (SAS-A), and Children's Depression Inventory (CDI) to account for anxiety and depression. Parents completed the Social Responsiveness Scale (SRS), Child Behavior Checklist (CBCL), Social Anxiety Scale for Adolescents, Parent (SAS-P) and Stress Index for Parents of Adolescents (SIPA) to gauge autism-related behaviors, anxiety, depression, social anxiety, and parenting stress, respectively. Adolescents completed a resting-state paradigm wherein respiratory sinus arrhythmia (RSA) was collected as a measure of arousal. Adolescents who completed the intervention (completers, *n*=134), both experimental and waitlist participants, were compared to those who withdrew (non-completers, *n*=20).
Results: Significant correlations with the binary completer variable were uncovered for SRS Motivation (*r*=-.157, *p*=.047), CDI Total (*r*=-.316, *p*=.009), and SIPA Delinquency/Antisocial (*r*=.159, *p*=.049). No other subscales, FSIQ, ADOS Total, or RSA, were significantly correlated with completion status. Logistic regression analyses were conducted separately for each measure as a predictor related to completion status (SRS Motivation, CDI Total, and SIPA Delinquency/Antisocial). SRS Motivation reliably distinguished completers and non-completers (chi square=3.995, *p*=.046, *df*=1), Nagelkerke's R^2 of .046 indicated a relationship between prediction and grouping. Prediction success overall was 87.7% (100% completer, 0% non-completer). CDI Total reliably distinguished completers and non-completers (chi square=7.019, *p*=.008, *df*=1), Nagelkerke's R^2 of .157 indicated a relationship between prediction and grouping. Prediction success overall was 82.4% (98.2% completer, 15.4% non-completer). SIPA Delinquency/Antisocial did not reliably distinguish completers and non-completers (chi square=3.538, *p*=.060, *df*=1).
Conclusions: Results suggest that low social motivation, low depressive symptoms, and high delinquency may contribute to withdrawal from PEERS®, however results are limited. General anxiety, autism-related behaviors, most parent stressors, and arousal were not related to, nor predictive of, dropout. It is possible that there is too much variability for what contributes to withdrawal from PEERS® for one family compared with another. The present study was also comprised of a small sample of participants who withdrew; future studies with larger samples may be better able to deduce contributors that interfere with completion of PEERS®.

202 **181.202** An Innovative, Urban, Diverse Teen Mentoring Initiative

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Background:
The Autism Program at Boston Medical Center(BMC) has implemented an innovative teen mentoring initiative for youth with Autism Spectrum Disorders (ASD) to address the challenges associated with ASD, adolescence and adult transitioning. Teens Engaged as Mentors (TEAM) aims to empower diverse urban youth through a model that uses mentor dyads (youth with ASD paired with neurotypical youth) to facilitate strong leadership, self-confidence and positive community engagement.Â Taking place across the 2015-2017 school years, key elements of TEAM include training and supervision for mentors, facilitated monthly community service project “hangouts,” and recreational social events.
Objectives:
1) Describe the impact of the TEAM program on participants and key stakeholders with respect to leadership, social awareness, self-esteem, independence/autonomy and community engagement.
2) Identify the key aspects of the mentor relationship that contribute to these outcomes.
Methods:
Researchers conducted three focus groups with stakeholders of the TEAM program. A convenience sample was used to recruit 8 parents of mentees, 5 mentees (all diagnosed with ASD) and 7 mentors (4 neurotypical, 3 diagnosed with ASD). BMC institutional IRB approval was granted and consents were obtained verbally. The focus groups were audiotaped and transcribed and uploaded to a password/protected secure website that is HIPAA compliant. We used a grounded theory framework and standard qualitative analysis techniques of thematic content and comparative analyses Five researchers independently coded the transcripts for key themes and patterns. To ensure inter-rater reliability, coding schemes were compared across stakeholder interviewers and discrepancies were resolved until consensus was reached. Final results compared themes by stakeholders, diagnoses and gender.
Results:
Results revealed numerous perceived benefits of TEAM across all stakeholders, including observations of growth in the areas of self-esteem, confidence, socialization independence and communication skills. Mentors and Mentees described how they gained skills in teamwork and making new friends from the program. Mentors shared how they learned patience, acceptance and being open-minded toward others. Mentees expressed they learned from their mentors the importance being authentic and real, making connections to others, and helping others. Parental feedback highlighted the overarching need for programming such as TEAM due to their child’s struggles with peer isolation, anxiety, and understanding social norms within groups and experiences of restricted community access. Community engagement and the importance of giving back to others was cited by parents, mentees and mentors as a unique aspect of the TEAM interventions.
Conclusions:
This formative research study indicates that teen mentoring is having a positive impact on promoting skills such as socialization, independence and autonomy for both youth with ASD and neurotypical youth. For all youth, mentoring can promote cultural diversity and acceptance of others, build self-confidence and enhance teamwork. Teen mentoring programs that provide structured learning opportunities and community service programs may be an effective strategy for helping youth with ASD foster independent living skills as they transition to adulthood.

203 **181.203** Applying the Theory of Change Approach in a National Autism Charity – Benefits, Challenges and Issues in Selecting Measures.

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Background: Large autism charities typically undertake a wide range of activities including human services, information and signposting, training, campaigns and research. These activities may have emerged over a long period, sometimes in response to need or opportunistically due to funding, without a clear strategy or overarching aim. A theory of change is a planning tool that maps a charity’s path from needs and inputs, to activities, outputs and outcomes. A well constructed theory can bring clarity to a charity’s activities and purpose, and identify assumptions about causality, gaps in activities, and suitable performance measures.
Objectives: (1) To produce an overarching theory of change for a leading nationwide autism charity, to help clarify its strategy and how each service or department contributes to its aims (2) to produce a ‘dashboard’ of performance measures aligned to the theory of change, to report to the charity’s CEO, board of trustees, staff, autism community and other stakeholders.
Methods: Workshops and consultation events were held with staff, trustees, autistic people, families, autism professionals, volunteers, donors, elected representatives, journalists and academics. The initial aim was to identify core beliefs about what the charity should stand for. These were translated into an overall aim. A second round of workshops was held with key staff to develop elements of the theory of change relating to autism professionals, education, human services, public awareness, employers and businesses. Autistic people and families were consulted on the outcomes of most importance to them as part of a national online survey in standard and Easy Read formats. A team of government analysts provided volunteer hours to help identify suitable data sources.
Results: N/A
Conclusions: Producing a theory of change proved worthwhile as it helped to clarify aims and accountabilities, and promoted the distinction between activities (e.g. training), outputs (e.g. autism aware professionals) and outcomes directly experienced by autistic people. It also proved useful in making the case for funding for autism services. A theory of change for a national autism charity is likely to be complex, given the range of challenges faced by autistic people across the life course. There are some limitations to this approach: the evidence base for autism interventions is poor, meaning assumptions about causality are weak; and although being understood, appreciated and supported were seen as important by all stakeholders, there is no consensus within the autism community on outcome measures. Using quantitative measures in an autism setting also exposes a number of issues: many autistic people are undiagnosed and so will not be represented in most data sources; measuring the indirect impact of training and campaigns is difficult; direct support for autistic people usually lacks a counterfactual; a person centred approach works against standard measurement; activities and outcomes for the relatively small number of autistic people with the greatest support needs can get ‘lost’ among bigger numbers. However on balance, the process has been positive as it creates an impetus for improving measurement, and challenges the practice among autism charities of reporting mainly activity measures, rather than outcomes.

204 **181.204** Behavior Analysts & Speech Pathologists: Perspectives Regarding Theories and Treatment of Autism Spectrum Disorder

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Background: Currently both Behavior Analysts (BA) and Speech Language Pathologists (SLP) provide intervention services for children with ASD. It is not known how much overlap exists between the two disciplines, particularly with regard to theoretical perspectives and intervention practices. SLPs primarily view language through cognitive, developmental frameworks while BAs regard language development from a behavioral perspective. With regard to intervention, SLPs often use a developmental framework for planning intervention and BAs engage in elements of behavior skills training. While there are some approaches such as Naturalistic Developmental Behavioral Interventions where collaboration and interdisciplinary treatment is expected, the majority of SLPs and BAs work independent of one another.
Objectives: Given the challenges that are facing both SLPs and BAs when it comes to supporting children with ASD, it is imperative that we identify ways in which both disciplines can find ways to collaborate effectively. This research is a first step at identifying 1) the theoretical perspectives, and 2) the intervention strategies utilized by members from both disciplines when assessing and treating individuals with ASD.
Methods: A survey was created to identify what types of theories and interventions SLPs and BAs are utilizing in their practice with individuals with ASD. As this is a relatively new area of research, the survey was created based on the author's extensive experience in both disciplines with feedback from expert's in each field. The survey included ten different scenarios followed by a series of answers that were to be selected based on the participants' education and experience. A total of 147 responses were collected. A descriptive analysis to determine similarities and differences in responses from participants was conducted.
Results: Â Responses seem to indicate clear theoretical differences for language acquisition with multiple perspectives dispersed across SLPs while a singular theory is evident among BAs. SLPs responses are spread out across Cognitive/Semantic, Psycholinguistic/Syntactic, Behavioral, and Pragmatic with Cognitive/Semantic garnering 41% of the response. On the other hand, 91% of BAs chose a behavioral construct to language acquisition. Among dually certified individuals, the majority still reside with a behavioral approach (77%) with only 15% indicating a cognitive/semantic approach. These differences may be an indicator as to why there are distinct differences in the intervention approaches subscribed to by each discipline. Behavior analysts overwhelmingly responded to intervention scenarios with behavior analytic strategies (i.e., task analysis, video modeling) and SLPs chose responses that may indicate the use of intervention strategies supported by a developmental, cognitive approach to language acquisition (i.e., visual cueing, social story).
Conclusions: The very definition of ASD indicates that both disciplines are required to address complex needs. While there is a difference in theoretical ideology and approaches to intervention, both SLPs and BAs often have similar outcomes in mind; however, both disciplines would benefit from more familiarity with evidence based practice recommendations as reported by the National Autism Standards. Continuing education across disciplines, as well as inter-professional education to learn about evidence based approaches from the other disciplines is recommended.

205 **181.205** Can We Increase Educational Professionals' Self-Efficacy to Teach the Autism Curriculum?

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Background:
As self-efficacy has been related to many positive benefits in the classroom, and related services, research has begun to look at self-efficacy effects during educator training. General self-efficacy measures appear to make little contribution. *Autism specific* self-efficacy measures are currently being developed and validated. The Autism Self-Efficacy Scale for Teachers (ASSET; Ruble et al., 2013) holds promise and integrates well with our training model.
Our training program is a state-wide, intensive training based on structured teaching principles. The week long, interactive training provides an opportunity to receive in-vivo supervision and feedback from experienced trainers. Through lectures and hands-on construction of visual supports and materials, participants create a classroom, work with children with ASD and teach the autism curriculum. The training is open to teachers and other educational professionals (e.g. Speech, Psychology). To further study the effects of our training model, we added the ASSET measure to our evaluation protocol.
Objectives:
This study investigated the effectiveness of the training model to increase educational professionals competence in delivering the autism curriculum. The study addressed: (i) educator change in self-efficacy pre and post training.
(ii) the relationship of educator self-efficacy to professional experience prior to training.
Methods:
All participating educational personnel (n= 62) who attended the hands on 5 day training workshop, completed the ASSET questionnaire pre and post training. ASSET is a 30-item self-report measure designed to assess ASD specific knowledge and skills. Each question is rated on a 1-100 scale.
To determine if individual variables affect self-efficacy, educators also provided information related to their educational qualifications, number of years in the profession, and experience with students with ASD.
Results:
i) T-test revealed that for the whole group, there was a significant ($p<.001$) increase in ASSET scores pre and post training.
ii) Baseline ASSET scores were divided by the mean score to create high and low self-efficacy groups. To determine the effect of prior experience on educator self-efficacy, data was entered in a logistic regression model with group membership (high and low self-efficacy) as the dependent variable, and lifetime number of ASD students, educational level, and years teaching as covariates. There were no significant effects of professional experience predicting self-efficacy group membership.
Conclusions:
These results indicate the effectiveness of our training program. By attending the training, educators increased their confidence in their ability to teach the autism curriculum, at any level of ability, to individuals with ASD.Â Educators in both the low and high self-efficacy groups increased their scores over the training period. Furthermore, educators' self-efficacy for autism strategies appeared to have little relationship to their prior professional experience, experience with autism or their educational level. This has important implications for training educational professionals. Even professionals who have many years teaching experience, or who have taught many students with ASD, can increase their autism teaching self-efficacy by attending an intensive training. Our follow-up study will determine if self-efficacy predicts *implementation* of specific strategies in the classroom following training.

206 **181.206** Command & Control Cognitive Training: Executive Functioning Intervention for Teens & Young Adults with ASD Pilot Study

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Background:
Individuals with ASD are rapidly developing into teens and young adults (Lord & Bishop, 2010) and are in need of functional cognitive skills necessary for positive livelihood (Duncan & Bishop, 2013;) those with these skills demonstrate increased vocational and educational outcomes (Taylor & Mallick, 2014). Executive functioning (EF) skills are the cognitive skills most frequently impacted in autism spectrum disorders (Kenworthy, Yerys, Anthony, & Wallace, 2008). EF skills have been found to be associated with reduced adaptive functioning (Gilotty, Kenworthy, Sirian, Black, & Wagner, 2002) and greater ASD symptoms (Kenworthy, Black, Harrison, Della Rosa, &Wallace, 2009). Many EF abilities improve through childhood and adolescence but mature more slowly and often remain impaired into adulthood in individuals with ASD peers without direct intervention (Rosenthal, 2013).
Objectives:
This study developed a novel treatment, Command & Control Cognitive Training, which is an innovative manualized small group executive functioning curriculum. A pilot study was conducted to obtain estimates of effects of outcomes which include executive functioning skills for teens and young adults with ASD.
Methods:
A total of 14 individuals with ASD (10 teens, 15= yrs, 4 young adults, μ=23 yrs) participated in an open trial pilot study of the Command & Control Cognitive Training program. Command & Control was delivered weekly for 90 minutes via active group participation. In addition, there was a weekly 30 minute parent education component conducted simultaneously with the participant group. The program involves 12 sessions over 3 months with an engaging "tech/gaming focused" curriculum teaching the participants "Commands" which were the following executive functioning skills: sustained attention, cognitive shifting, cognitive flexibility, problem solving, inhibition, goal-oriented thinking, and organization and "Controls" which were specific strategies to use for each construct (i.e. Tune in, Eliminate Distractions for sustained attention). Pre and post assessments included a battery of standardized measures: 1. Behavior Rating Inventory of Executive Function (BRIEF & BRIEF-A), 2. Social Responsiveness Scale-2 (SRS-2) and 3. Satisfaction questionnaire. Participants and parent informants completed each measure. The participants were diverse with about half female (43%) and diverse race/ethnicity (35%). Some were involved with various social services: 57% disability services, 71% special education, and 57% receiving therapy (29% mental health, 50% speech, 43% occupational).
Results:
Analyses consisted of paired-sample t-tests and Cohen's d effect sizes to estimate intervention effects. Preliminary findings reveal small to large positive effects per participant and parent report on the BRIEF/BRIEF-A. This may be a reflection of the effectiveness of the intervention. Small to large positive effects were also found on the SRS-2 subscales per parent report and minimal effects for participants (Refer to Tables). Program satisfaction was very high (8.5 participant and 9.3 parent, out of 10).Â
Conclusions:
This study demonstrates that the engaging "tech/gaming" focused executive functioning intervention, Command & Control Cognitive Training, was well received and demonstrated initial positive outcomes and overall satisfaction. Using small groups to teach EF skills to teens and adults shows promise.

207 **181.207** Comparing Social Skills Outcomes in Adolescents with ASD and Adolescents with ADHD Following the UCLA PEERS® Intervention

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Background:
Adolescents with ASD or with ADHD often exhibit social deficits (Macintosh & Dissanayake, 2006; Landau & Moore, 1991), which cause them to experience peer rejection or social neglect more than their typically developing peers (Jones & Frederickson, 2010; Hoza et al., 2005). The Program for the Education and Enrichment of Relational Skills (PEERS®) is an evidence-based parent-assisted social skills intervention that improves social skills in adolescents diagnosed with ASD (Laugeson et al., 2009; 2012), and adolescents diagnosed with ADHD (Gardner et al., 2015). While research suggests PEERS® improves social skills for these two groups, the difference in treatment outcomes between youth with ASD and youth with ADHD has yet to be investigated.
Objectives:
This study examines social skills outcomes in adolescents with ASD, compared to adolescents with ADHD, following the PEERS® intervention.
Methods:
Ninety-two adolescents (males= 74; females= 18) aged 11 to 17 years (*M*= 13.74, *SD*= 1.70) and their parents participated in the study. Participants attended PEERS®, a 14-week social skills program that includes 90-minute weekly group sessions that target the development and maintenance of social relationships. Seventy-two of the participants were diagnosed with ASD; 20 were diagnosed with ADHD. Adolescents diagnosed with both ASD and ADHD were excluded from the study. In order to assess treatment outcome, adolescents completed the Quality of Socialization Questionnaire (QSQ; Frankel & Mintz, 2008), which measures social engagement through the number of get-togethers with peers over the previous month. Parents completed the Social Responsiveness Scale-2 (SRS-2; Constantino, 2005), which measures the adolescent's ability to both pick-up on and interpret social cues, the motivation to engage socially, and other impairments such as stereotypical behaviors, highly restricted interests and limited expressive social communication. Both measures where administered pre- and post-intervention.
Results:
Results were analyzed using a Multivariate Analysis of Variance (MANOVA) using SPSS. Findings reveal that both groups significantly improved on the QSQ (T_1 (M = 3.08, SD = 3.54) and T_2 (M = 6.44, SD = 5.62) conditions; t(91) = -5.71, p<0.001) and the SRS-2 (T_1 (M=76.76, SD= 12.35) and T_2 (M= 68.22, SD= 11.04) conditions; t(91)= 8.037, p<0.001) following the intervention. However, there are no statistically significant differences between the ASD and ADHD groups with regard to treatment outcome.Â F(2, 89)=0.18, p>.05, Wilk's $\Lambda = 0.99$, partial $\eta^2 = 0.004$.
Conclusions:
These findings suggest that following the PEERS® intervention, adolescents with ASD and adolescents with ADHD exhibit improvement in social skills in the areas of greater social engagement through get-togethers with peers, and in improved social responsiveness. Results further demonstrate that there were no significant differences in treatment effects across the two groups, suggesting that both adolescents with ASD and adolescents with ADHD equally benefit from the intervention. One limitation in the current study was the relatively small ADHD sample size, something that could be addressed in future studies. Additionally, future research might examine the impact of having comorbid ASD and ADHD on treatment outcomes, as well as other factors including subtypes of ADHD, such as greater inattention and/or hyperactivity/impulsivity.

208 **181.208** Computer and Technology Club As Social Performance Intervention for Adolescents with ASD and Their Peers

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Background: Although many children with autism spectrum disorder (ASD) are integrated into general education classrooms, they lack opportunities to make friends and generalize acquired social skills outside of the classroom. Such challenges, if continued into adulthood without intervention, are likely to lead to social isolation, depression, and social anxiety (Hammond, 2012; Gillott, Furniss, & Walter, 2001) as well as obstacles to higher education and employment (Schall, 2010; Seltzer et al., 2004). There is emerging evidence that summer camps based on shared interest between children with ASD and typically developing (TD) children can be effective at increasing social skills and decreasing social anxiety in adolescents with ASD (Kaboski et al., 2015). This current study adapted the camp into an after school club, which was offered in a format that allowed adolescents with ASD to learn and practice social skills in a more natural environment over a longer period of time (i.e., once a week for 4 months) than a week-long summer camp.
Objectives: The Computer and Technology (CAT) Club provided a series of technology-related sessions in which adolescents with ASD could practice appropriate social and collaborative skills with neurotypically developing peers in an engaging and supportive environment. The club highlighted strengths and shared interests of participants, rather than ASD or social deficits. The objective of this study was to see if the CAT Club would effectively support the social and vocational development of individuals with ASD through: (1) a decrease in social anxiety, (2) an increase in social performance, and (3) an increase in knowledge of computer game programming and robotics.
Methods: Participants were 8 individuals with ASD and 8 TD peers, ages 12-17, who expressed a special interest in computer and technology. Parent reported ASD diagnoses were independently confirmed using ADOS-2, SCQ-L, and clinical judgment. During the semester-long club, social/vocational training was given to all participants, regardless of diagnosis, and participants were not labeled as having ASD. While programming, participants worked in pairs (1 ASD: 1 TD) on a programming project that culminated in a presentation in front of peers and family. Pre- and post-treatment data were collected on social anxiety, social skills, and participants' knowledge of computer and technology.
Results: A series of paired samples *t*-tests were conducted to compare the baseline data with post-test data. ASD group demonstrated a significant improvement in measures of social skills and social anxiety (see Table 1). TD group did not experience any change in social skills or social anxiety; however, it should be noted that the TD participants came in with above average level of social skills and levels that are significantly below the clinical cut off for social anxiety. For both groups, there was a significant improvement in knowledge of computer game programming and robotics.
Conclusions: These results provide a preliminary support for the effectiveness of an after school club at decreasing social anxiety, increasing social skills, and improving technical knowledge in adolescents with ASD.

209 **181.209** DBT-Informed Group Treatment to Improve Emotion Regulation and Social Interactions in Young Adults with Autism Spectrum Disorder

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Background: Few treatments are currently available to treat common difficulties experienced by individuals with autism spectrum disorder (ASD) in adulthood, especially for emotion regulation (ER), and social interaction. Dialectical Behavior Therapy (DBT) is a cognitive behavioral treatment approach that continues to be adapted for a variety of diagnoses from its original conception for Borderline Personality Disorder. DBT includes skill training sessions on mindfulness, interpersonal effectiveness, ER, and distress tolerance. To our knowledge, DBT has not yet been used for ASD. Given the ER difficulties young adults with ASD (YA) face, with overwhelming negative affect regulation (e.g. intense anxiety and anger), treatment components of DBT may lend themselves to successful adaptation with this population.
Objectives: The overarching goal of this study was to pilot a DBT-informed intervention to target ER difficulties in YA with ASD, with a particular focus on anxiety and anger. Specific aims included modification of existing interventions to develop a manualized DBT-informed intervention to meet the needs of YA with ASD and examination of feasibility and preliminary effectiveness of the intervention in reducing ER difficulties and improving social interaction skills.
Methods: Â 8 YA participants (3 females, ages 18-25) were recruited from clinical providers and advocacy organizations. All participants' ASD diagnoses and IQ (> 80) were confirmed through administration of the ADOS and WASI by research team members. 2 senior clinicians with ASD expertise led the 14 session groups (12 consecutive weekly sessions with 1 and 6 month follow up sessions) in an outpatient clinic of a medical school. Group sessions were 90 minutes and included a 30-minute didactic portion and a 60-minute imaginary and in-vivo exposure to practice specific anxiety and anger management skills. Through feedback from two previous pilot groups, DBT treatment duration was shortened to 12 weekly sessions and mindfulness practice, modeling in social interaction, video clips, and images were added into each session. Participants also practiced imaginary and real life exposures to manage their anxiety, in clinical and community settings. Effectiveness of treatment was measured by improvements in the Social Responsiveness Scale (SRS), Buss-Perry Aggression Questionnaire, Aberrant Behavior Checklist, Emotion Regulation Questionnaire, and Social Phobia and Anxiety Inventory-2
Results: Preliminary paired samples t-tests assessed changes in ER before and after the initial 12 sessions. Results showed that participant report on the SRS SCI (awareness, cognition, communication and motivation), awareness, and cognition subscales (all $p < 0.04$) subscales significantly improved. Results from the parent report on the SRS total score, and SCI, RRB, and communication subscales had trending results towards improvement (all $p < 0.08$). Post-treatment data collection will be completed in December 2016. RM-ANOVA will be conducted to evaluate changes over time and maintenance of treatment effects.
Conclusions: This treatment study used clinical adaptations from established manualized treatment approaches (DBT and CBT) to improve ER and social interaction skills of YA. DBT intervention was able to be successfully modified and delivered to YA's with ASD. Preliminary evidence suggests that this intervention may serve to improve deficits commonly experienced by YA's, in particular social interaction skills/awareness.

210 **181.210** Design and Efficacy of a Wearable Device for Social Affective Learning in Children with Autism

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Background: Children with autism struggle to recognize facial expressions, make eye contact, and engage in social interactions. The best-known intervention, applied behavioral analysis, relies on teaching these skills in a clinician's office, removed from where they will actually be used and relying on artificial tools like flashcards. Their delivery is increasingly bottlenecked as the number of available therapists lags well behind by the number of children in need of care.
Objectives: We have developed a tool for automatic facial expression recognition that runs on smart glasses and delivers social cues to people with autism. The system employs the glasses' outward-facing camera to read a person's facial expressions by passing video data to an Android app for machine learning-based emotion classification, giving the child wearer real-time social cues. We, through an in-lab pilot and an at-home design trial, sought to refine both the interaction experience and outcome measures that can then be employed to track progress in a more controlled trial.
Methods:
For the in-lab pilot, we tested an interface mockup on 20 autism and 20 control participants. Each of the participants was fitted with the mockup and a custom-built head-mounted pupil tracker while sitting in front of a computer screen. The screen showed faces for 6 seconds alongside two alternating non-social standardized "distractor" images. Subjects attempted to identify the emotion of faces on the screen first without emotion feedback, then with feedback provided via the heads-up display and/or audio system of the unit, and again without feedback.
For the at-home design trial, we worked exclusively with children with ASD. We asked 14 families to take the working prototype home and use it for at least 20 minutes at least 3 times per week. We tracked behavioral progression through the continuously gathered device data and the Social Responsiveness Scale (SRS), a parental report measure.
Results:
In-lab results showed that children adapted quickly to wearing the device; audio feedback promoted a shorter learning curve. Both groups showed improvements in batches 2 and 3. Preliminary qualitative analysis of the eye tracking data collected in this study agreed with the finding that children with autism focus their gaze on the mouth as opposed to the eyes when looking at faces.
For the at-home trial, six participants moved from one range of autism on the scale to a less severe one (4 from "severe" to "moderate", 1 from "moderate" to "mild", and 1 from "mild" to "normal"). The mean total SRS score (a higher score indicates a higher severity of ASD) during the on-boarding sessions was 79.36 (SD=34.92), while the mean total SRS score during the trial conclusions was 72.69 (SD=10.67). This preliminary exploration produced over 9,000 minutes of social video and sensor data, a dataset bigger than any other of its kind.
Conclusions: These trials provided valuable data on the use of such a tool. These results together provide us with a therapeutic tool for which we have strong hypotheses that can now be measured with a more controlled trial.

211 **181.211** Developing an Autism-Specific Workplace Tool for Employers

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Background: Adults on the autism spectrum are mostly as motivated to engage in employment as adults in the general working population. Despite many adults on the autism spectrum having high levels of skills limited employment opportunities often result in them being unemployed. The need to support adults on the autism spectrum in employment is internationally recognised. Limited research exists from the perspective of employers and the impact of modifying environmental factors on employment outcomes of individuals on the autism spectrum. This study explores the development of an autism-specific workplace tool, the Integrated Employment Success Tool (IEST), designed to support employers in modifying the work environment for employees on the autism spectrum.
Objectives: Developing the IEST to enhance employers' abilities and confidence to modify the work environment for employees on the autism spectrum in open employment.
Methods: Â Development of the IEST was informed by three studies: 1) Q-methodology study obtaining the viewpoints on successful employment from 40 adults on the autism spectrum in open employment and 35 of their employers; 2) a literature review of current employment programs and interventions in the workplace for adults on the autism spectrum; and 3) piloting a prototype tool with 10 employers.
Results: Development of the IEST was informed by the main findings from the Q methodology study, that successful employment of individuals on the autism spectrum requires workplace support, clearly communicated job expectations and knowledge of productivity requirements. Findings from the literature revealed few studies exploring employers' perceptions and the impact of environmental modifications on workplace success. Piloting resulted in a standardised tool, which aims to support the employment process across five phases, from recruitment, interviewing, job commencement, workplace modifications and ongoing support. The IEST is a practical guidebook that contains strategies, checklists and resources for each phase of the employment process. The IEST has been designed to assist with identifying employee strengths, recognising potential difficulties that might occur in the workplace, steps to evaluate the environment and strategies to implement to assist with modifying the workplace throughout the employment process.
Conclusions: The piloting of the IEST confirmed employers' need for a tool to assist with work environment modifications for employees on the autism spectrum. The IEST was perceived as a reliable source of information and to enhance employers' confidence and communication working with employees on the autism spectrum. The IEST was also reported to result in overall improvements within the organisation, particularly during the interview and recruitment process of employees on the autism spectrum.

212 **181.212** Development and Validation of a Virtual Reality Intervention for Adaptive Outdoor Activities in Autism Spectrum Disorder

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Background:
Teaching a person with autism spectrum disorder (ASD) for outdoor activities such as the use public transports requires parents or therapists to practice with them, until they are ready and comfortable enough to engage in these activities independently and alone. In fact, being able to efficiently use public transports can be particularly challenging for people with ASD due to deficits in adaptive behaviour and anxiety. Virtual reality (VR) simulations represent potentially useful teaching tools for ASD individuals because they create safe and simplified versions of the real environments, providing repetition and control over the elements in the scene. Furthermore, ASD participants have a preference for computerized interventions, which suggests that serious games should be able to produce suitable results as teaching tools for daily activities. Therefore, we developed a serious game designed for teaching the user how to adequately take a bus to reach a desired destination.

Objectives:
To understand if serious games with virtual reality are effective in teaching bus taking routines and procedures to individuals with ASD.

Methods:
Participants with ASD (n=10) underwent up to three therapy sessions, where they received tasks in the game of increased difficulty (i.e., having to commute between buses to reach the destination). Matched articipants with typical development (n=10) performed one session for performance comparison with the ASD group.
The game consisted of a three-dimensional city where participants received tasks which involved taking buses to reach specific destinations. On this city, they had access to a map indicating the bus lines and the stop, and were given a target destination. They then had to find a bus-stop, wait for the right bus, enter, validate the ticket, sit (avoiding reserved places), press the bell stop, leave the bus and reach the destination. Participants were immersed in this virtual world through Oculus® Rift, sat on a rotating stool with 360º of freedom and interacted with the game using a gamepad.
We collected in-game performance metrics and used a debriefing questionnaire to further assess the success of the intervention. The system recorded the correct and incorrect actions the player performed on the process.

Results:
Group differences were found for the number of faults in the process, proving the deficits of the ASD group in this task (Mann-Whitney U = 18.5, p = .012). Regarding the success of the intervention, a Willcoxon Signed Rank test showed statistically improvements between the first and last sessions (Z = -2.220, p = .026).

Conclusions:
According to our observations, by using the game as a intervention training tool, in just three sessions it was possible to improve the general efficiency of participants and expose them to peculiar scenarios in which they could train their planning skills. The developed game stands out for its use of emerging, immersive, virtual reality technologies, whose use in intervention and serious games is still in its infancy.
Serious VR games can be used effectively in teaching people with ASD become more independent, specifically regarding outdoor activities such as the use of buses for transportation, whose know how also applies to most public transportation systems.

213 **181.213** Effect of N-3 Polyunsaturated Fatty Acid on Behavioral Response in Autism: A Systematic Review and Meta-Analysis

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Background: Â The deficits of n-3 polyunsaturated fatty acid (PUFA) is thought to be associated with behavioral abnormalities in autism spectrum disorder (ASD). However, the effectiveness of n-3 PUFA intervention aimed at improving the behavioral symptoms in ASD children has not been well established.
Objectives: Â To examine the effects of n-3 PUFA supplement on behavioral response in ASD children.
Methods: Â We searched PubMed, EMBASE, PsychINFO, Scopus, the Cochrane Library, SinoMed, CNKI, VIP and Wanfang database through February 12, 2016 for relevant full-text articles in English or Chinese. Randomized controlled trials (RCTs) were selected if they implemented n-3 PUFA supplement for at least four weeks in ASD and reported behavioral outcomes. The quality of the studies was examined by the Cochrane Collaboration's tool for assessing risk of bias. Fixed-effects models were used in the meta-analysis.
Results: Among the 1502 identified articles, seven RCTs (n =216 subjects) were included. A few sporadic significant improvements were found in the n-3 PUFA group regarding social functioning, emotional and externalizing problems. Meta-analysis of four included RCTs applying the Aberrant Behavior Checklist (ABC) revealed significant improvements in the n-3 PUFA group compared to the control group with pooled effects of -1.98 (95% CI: -3.57, -0.39; P=0.015) in social withdrawal and -1.11 (95% CI: -2.18, -0.04; P=0.042) in stereotypic behavior of the ABC. Non-significant improvement on inappropriate speech, hyperactivity and irritability in the n-3 PUFA group was found. Variability in other behavioral outcomes across studies precluded meta-analysis.
Conclusions: N-3 PUFA exerted significant improvements in social withdrawal and stereotypic behavior of ASD children. There was still insufficient evidence regarding the effect of n-3 PUFA on other behavioral response. More robust studies are required to establish full efficacy of n-3 PUFA supplement.

214 **181.214** Effectiveness of a Caregiver Mediated Intervention in Publicly -Funded Mental Health Services: Factors Associated with Improvements in Parenting Self-Efficacy

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Background: AIM HI ("An Individualized Mental Health Intervention for ASD", Brookman-Frazee and Drahota, 2010) was developed in response to the need for an implementable, evidence-based (EB) intervention for delivery in mental health service (MH) settings. AIM HI is a package of EB strategies designed to reduce challenging behaviors, the most common presenting problem for children with ASD in MH services. Active caregiver involvement in facilitating child skill development is a critical component of AIM HI and consistent with EB practices for ASD. Thus, the impact of treatment on parenting self-efficacy is an important outcome. There is limited research on the effectiveness of parent-mediated interventions when delivered by community providers. The current study examined the impact of training community providers in AIM HI on caregiver parenting self-efficacy. Data were drawn from a large-scale randomized community effectiveness trial of AIM HI conducted in publicly-funded outpatient and school-based MH programs.
Objectives: (1) Examine the impact of AIM HI on changes in parenting self-efficacy from baseline to 6 months. (2) Identify caregiver characteristics and session attendance, and therapist fidelity associated with changes in self-efficacy for caregivers in the AIM HI training condition.
Methods: A waitlist control design was used in which MH programs were randomized to either immediate AIM HI training or Usual Care/Delayed AIM HI training conditions. Therapist and client dyads were enrolled from participant programs. A total of 202 client/therapist dyads were included. Child participants were 84% male, an average of 9.13 years (SD=2.44) and 70% Hispanic. Caregivers were 93% female and 61% Hispanic. The Parenting Sense of Competence Scale (PSOC; Ohan et al., 2000) was the primary outcome measure used and was collected at baseline and after 6 months. Trainer, therapist and caregiver ratings of therapist fidelity were collected after 6 months.
Results: Results from two-level (time nested within client) mixed-effects model indicated a significant group by time interaction for parenting self-efficacy. Specifically, caregivers of children whose therapists completed AIM HI training reported significantly improved parenting self-efficacy compared to caregivers who received Usual Care, $B = 3.22$ ($SE = 1.57$), $p < .05$. To guide post-hoc analyses to probe this treatment effect, bivariate analyses were performed between each proposed predictor and PSOC scores for the AIM HI condition only. The three characteristics (ethnicity, baseline caregiver strain, and caregiver-rated therapist fidelity) that were significantly associated with parenting self-efficacy in the bivariate models were entered into a multilevel multivariable model. Results revealed a significant interaction between time and caregiver rated therapist fidelity, $B = 2.57$ ($SE = 0.88$), $p < .01$, indicating that caregiver perceptions of therapist fidelity (i.e., therapist use of active teaching skills directed towards the caregiver) was associated with improved parenting self-efficacy. Caregiver ethnicity and baseline caregiver strain did not moderate the treatment effect.
Conclusions: These results provide empirical support for the effectiveness of AIM HI on a key targeted outcome when delivered by community providers and highlight the importance of targeting therapist fidelity in bolstering clinical outcomes.

215 **181.215** Effectiveness of a Computer-Assisted Cognitive-Behavioral Therapy Program in Treating Youth with Anxiety and Co-Occurring Autism Spectrum Disorder: Camp Cope-a-Lot

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Background: It has been reported that nearly 40% of children and adolescents with a diagnosis of ASD meet clinical criteria for at least one co-morbid anxiety disorder (van Steensel, Bögels, & Perrin, 2011) and those with high functioning autism (HFA) experience more anxiety than those with low functioning ASD and accompanying intellectual impairment (White, Oswald, Ollendick, & Scahill, 2009). Cognitive behavioral therapy (CBT) is most often used for treating anxiety ASD youth. Across the limited amount of studies, positive outcomes have been reported, providing preliminary evidence for CBT as an effective treatment modality for anxiety in individuals with HFA or AS (Lang, Regester, Lauderdale, Ashbaugh, & Haring, 2010; McNally Keehn, Lincoln, Brown, & Chavira, 2013; Sofronoff, Attwood, & Hinton, 2005; Wood et al., 2009). In 2008 Kendell and Khanna introduced Camp Cope-A-Lot: The Coping Cat CD Rom (Kendall & Khanna, 2008a), which is a computer-assisted CBT intervention for anxiety in youth based off of the Coping Cat program framework. No studies to date have evaluated the effectiveness of this treatment package for reducing anxious symptoms in children with ASD.
Objectives: The aims of this study was to examine the effectiveness of an empirically supported, computer-assisted CBT intervention for reducing anxiety symptoms in youth with ASD.
Methods: Participants included twenty-seven 8 – 15 year-old children with a diagnosis of ASD and clinically significant anxiety symptoms consistent with Separation Anxiety Disorder, Generalized Anxiety Disorder, Specific Phobia, or Social Phobia. Anxiety disorder classifications were confirmed using the Anxiety Disorders Interview Schedule – Parent Version (ADIS-P). All participants scored ≥ 70 on measures of intellectual and language abilities. Participants were randomly assigned to either 12 sessions of computer-assisted CBT, CCAL (n=15) or a 12-session computer assisted program aimed to improve social skills rather than improve anxious symptoms, The Social Express (TSE) (n=12). Kendell and Khanna's (2008a) twelve-session CCAL CD Rom for anxious children was employed as the primary intervention. Anxiety outcome measures included ADIS-P Parent Severity Ratings (PSR) as well as parent and child ratings on the Multidimensional Anxiety Scale for Children (MASC) and Spence Children's Anxiety Scale (SCAS). Social skills outcome measures were used and the primary outcome measure included the Social Skills Improvement System Parent Form (SSIS-P) total scores as well as total scores on the Social Responsiveness Scale (SRS) and self-report Friendship Quality Scale (FQS) total scores.
Results: Preliminary findings suggest that some children who completed a 12-session CBT computer assisted program evidenced clinically significant reductions in anxiety symptoms as measured by the primary and secondary outcome measures. Comparative outcomes for participants in the CCAL and TSE interventions groups will be presented.
Conclusions: Preliminary evidence suggests that the Camp Cope-A-Lot CD Rom for anxious children may be an effective treatment for reducing anxiety symptoms in children with ASD and co-occurring anxiety. Furthermore, preliminary evidence suggests that the alternate computer assisted intervention; The Social Express may be an effective program in improving social skills acquisition as evidenced by social skills outcome measures.

216 **181.216** Effects of a Classroom-Based Music Therapy Model on Social Skills for Children with Autism Spectrum Disorder

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Background: Students with autism spectrum disorder (ASD) and related developmental disabilities have marked deficits in social and communication skills, which can broadly impact their ability to participate in academic and social activities at school. Music therapy is an increasingly popular intervention for children with ASD, and research evidence supporting its effectiveness is growing. In multiple intervention studies, music therapy produced greater results than standard care with respect to social interaction, verbal and non-verbal communication skills, and social-emotional reciprocity. Additionally, a recent study found that for people with ASD, the areas of the brain that process both speech and song are more effectively engaged during song than during speech. This suggests that musical interaction techniques may provide a promising approach for teaching language and communication. The *Voices Together*® program is a classroom-based music therapy model that utilizes a structured, non-directive approach to teach communication and social-emotional skills. A preliminary study on weekly sessions of *Voices Together*® demonstrated improvements in verbal responsiveness over a period of 15 weeks.
Objectives: To identify the effect of a specialized music therapy program, *Voices Together*®, on communication and social-emotional skills in children with ASD.
Methods: Sixty-four students were recruited to participate from nine elementary school classrooms for children with ASD. All students completed a clinician-administered set of 20 prompts focused on communication and social-emotional adjustment at three baseline time points before treatment began. Trained music therapists then offered the *Voices Together*® intervention for 45 minutes, once a week, for 16 weeks. Students completed the same set of prompts during three treatment time points. In addition, teachers completed the PDD Behavior Inventory (PDDBI) for each student before treatment began and at its conclusion.
Results: Paired t-tests between baseline and treatment indicate statistically significant differences between prompt scores at Baseline 2 (M=29.37) and Treatment 2 (M=32.70), t(49) = 3.48, p<0.05, and between Baseline 3 (M=31.05) and Treatment 3 (M=32.96), t(53) = 2.89, p<0.05, with Treatment scores being higher than Baseline scores. Additionally, paired t-tests of pre- and post- PDDBI assessments indicated a significant decrease in social pragmatic problems (M_{pre} = 14.02, M_{post} = 11.97; t(52) = 2.08, p < 0.05), and a significant increase in expressive language (M_{pre} = 52.08, M_{post}= 55.31; t(52)= 2.45, p < 0.05).
Conclusions: Â While participating in *Voices Together*® music therapy, students' scores on a set of prompts designed to address communication and social-emotional skills increased more than during the non-treatment period. These differences suggest that participation in the music therapy program produced an effect over and above general learning and variability within the measure. Students' improvement in communication and social-emotional skills is further supported by the overall decrease in social pragmatic problems and increase in expressive language suggested by the PDDBI. Understanding the specific outcomes of classroom-based music therapy programs like *Voices Together*® provides further insight into the clinical application of music therapy techniques for the ASD pediatric population.

217 **181.217** Effects of a School-Based Exercise Intervention Program on Stress and Executive Functioning in Adolescents with Autism Spectrum Disorder or Other Special Education Needs

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Background: Extensive research has shown that physical exercise produces positive impacts on physical and psychological health indicators across numerous populations. With regards to psychological health, evidence suggests reduced stress and improved executive functioning as a result of exercise. As a clinical intervention, exercise has a number of advantages, including feasibility of implementation by staff at various levels of training, or by patients themselves, and completion at low cost to both the individual and society. Thus, exercise intervention has great potential to be a potent and pivotal intervention for improving the health and well-being of individuals with psychiatric disorders. Autism Spectrum Disorder (ASD) is associated with significantly elevated symptoms and rates of anxiety, as well as difficulties with executive functions including inhibitory control and attention switching. However, very little research has been conducted on exercise as an intervention for individuals with ASD to date.
Objectives: To investigate the impacts of a school-based exercise intervention on stress and executive functioning in adolescents with ASD or other Special Education Needs (SEN).
Methods: A Within-Subjects Experimental Design was utilized, with each participant partaking in 1) one week of Exercise Intervention (20-minutes of aerobic exercise per day), and 2) one week of Education As Usual (EAU). Intervention condition order was randomized across classroom (*n*=2), with ASD and SEN participants distributed across classrooms. The exercise intervention was implemented by regular school staff, without specialist equipment or resources. Participants were adolescents with ASD (*n*=24; 1f, 23m) or other SEN (*n*=29; 15f, 14m) with intellectual abilities within the normal to low range, matched on Chronological Age (p=0.24), Verbal Abilities (British Ability Scales Word Definition and Verbal Similarities; p=0.13), and Nonverbal Abilities (British Ability Scales Matrices; p=0.80). The Stress Survey Scale for Individuals with Autism or Other Pervasive Developmental Disorders (SSS; Groden et al., 2001), and computer-based tasks indexing the executive functions of Inhibitory Control and Attention Switching (Burns, Riggs, & Beck, 2012), were each administered during both the Exercise Intervention and EAU conditions. Experimentally blinded research assistants conducted these tasks within 90-minutes of completion of the 4th (Thursday) and 5th (Friday) sessions of each week.
Results: We observed significant reductions in self-reported stress with Exercise relative to EAU (SSS; Exercise M=97.04, SD=23.88; EAU M=107.71, SD=24.38, F(1,52) = 19.920; p < 0.001, np2 = .281). We also observed significant improvements in both of the Executive Function tasks. For the Inhibition Task, Exercise Intervention significantly reduced Congruent/Incongruent trial difference relative to EAU, reflecting improved inhibitory control (Accuracy: F(1,51) = 12.236, p < 0.001, np2 = .193). For the Attention Switching Task, Exercise Intervention reduced Switch/Non-Switch trial difference relative to EAU, reflecting improved attention switching ability (Accuracy: F(1,50)= 15.336, p < 0.001, np2 = .246). These effects did not interact with Group (ASD, SEN), and each effect maintained statistical significance when analyzed separately for the ASD and SEN groups.
Conclusions: The current findings provide evidence for the effectiveness of a school-based aerobic exercise intervention program for reducing stress and enhancing executive functioning in adolescents with ASD.

218 **181.218** Effects of rTMS on Evoked and Induced Gamma Oscillations and Event-Related Potentials in Children with Autism

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Background: Neuropathological, neuroimaging and electrophysiological studies indicate that the brains of individuals with autism spectrum disorder (ASD) manifest a dysfunction in neural circuitry that affects many disparate brain regions. The reported findings have led some investigators to conclude that a functional disconnection of brain regions is a core abnormality of ASD. Gamma oscillations and synchrony are important for the integration of information within and across brain regions. Recent studies indicate that gamma oscillations are involved in a variety of perceptual, cognitive and motor process that are affected in ASD.
Objectives: In this study we used gamma oscillations along with more traditional event-related potentials (ERP) in a visual oddball task with illusory figures as a functional marker of response to low frequency repetitive transcranial magnetic stimulation (rTMS) in children with ASD.
Methods: The subject population includes age, gender, and socio-economic matched ASD, and typically developing (TD) children aged 8-19 years. Behavioral evaluations as well as evoked and induced gamma measures and ERPs during visual oddball task with illusory figures tests was collected at pre-, post-TMS course in ASD group (N=23), and at baseline stage in TD group (N=21). After baseline behavioral and EEG/ERP testing the ASD subjects were assigned to 18 weekly sessions of 1 Hz rTMS over the left dorsolateral prefrontal cortex (DLPFC).
Results: Baseline test showed significant differences between ASD and TD groups mostly in terms of responses to non-target illusory figures where children with autism showed excessive evoked and induced gamma oscillation and higher magnitude of ERP as compared to children. Behavioral response differences were manifested mostly in lower accuracy of motor responses and lower error correction function. The rTMS course resulted in improved accuracy of motor response, lower evoked gamma response to non-targets and increased amplitude of induced gamma to target, along with similar improvements in ERP responses. Behavioral evaluation outcomes showed decreased irritability and hyperactivity scores and decreased rating of repetitive and stereotype behaviors.
Conclusions: The study support potential utility of gamma oscillations and ERP as ASD biomarkers for functional diagnostics and predictions of clinical and behavioral responses to rTMS in individuals with autism.

219 **181.219** Elementary School Students' Spontaneous Definitions of Autism

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Background: Â Inclusive education is thought to yield social benefits for students with autism spectrum disorder (ASD), in part, by facilitating social acceptance. Successful inclusion strategies are important as students with ASD experience less social acceptance and peer companionship than their peers.Â In order to facilitate acceptance and enhance peer education, it is important to identify what typical children know, think and believe about autism.Â Magiati et al. (2002) reported that no elementary school children had heard the word "autism;" more recent studies reported that 77% of elementary school students have heard of autism (Silton et al., 2011). Despite being aware of the term autism, most elementary school students report limited knowledge about defining features and associated difficulties for students with autism.Â For example, only 22% of students report that students with autism show social difficulties.
Objectives: Â In the present investigation, we update knowledge about elementary school students' conceptions of autism.Â Overall, we aim to further understand elementary school students' conceptions of autism to identify curricular targets for peer education interventions.
Methods: Participants were 220 students (110 boys, 110 girls), ages 9 to 12 enrolled in 4th or 5th grade in public elementary school. Investigators asked students if they had ever heard of autism and, if so, to provide a written definition of autism.Â Definitions were coded for accuracy and content with a revised version of Campbell et al.'s (2010) *"What is Autism?"* coding manual.
Results: Â A total of 109 (49.5%; *M* age = 10.11; *SD* = 0.76) of the participants reported having heard of the word autism; two students reported not hearing of autism, but provided a definition nonetheless.Â Within our sample, girls (58.7%; *n* = 64) were marginally more likely to have heard of autism when compared to boys (41.3%; *n* = 45), $\chi^2(1, N = 109) = 2.97$, $p = .08$.Â Accuracy coding decisions proved to be reliable with κ = .93 and 1.0 for two pairs of coders. Content coding was also reliable with κ ranging from .73 to 1.0 for one pair of coders and κ = .65 and 1.0 for a second pair. Most (73.6%) responses were judged to be accurate and a majority of respondents (67.3%) reported that autism was a disability; however, few identified social or communication difficulties (10.0%) or restrictive/repetitive behaviors or interests (0.9%) as characteristic of autism (see Table 1).
Conclusions: Â Roughly half of elementary school students in our sample reported having heard of autism and most reported understanding that autism is a disability; however, students reported little understanding about social, communicative, and behavioral difficulties characteristic of students with autism.Â Peers' definitions were remarkably similar to prior work with elementary schoolers. Peer education efforts should target improving students' basic understanding of autism to facilitate greater awareness and acceptance. For example, educational messages targeted to elementary school students should identify behaviors likely encountered within educational settings to understand and interpret autism symptomatology accurately. Improved and accurate interpretation of social, communicative, and behavioral symptoms may reduce misattribution and social distancing.

220 **181.220** Employment Works Canada, a National Program for Young Adults with Autism

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Background:
In the Canadian Survey on Disability (2012) 83% of respondents with autism spectrum disorder (ASD) reported no employment income. The literature suggests vocational supports fail to meet the needs of individuals with ASD and there is a lack of research regarding effective employment interventions for individuals with ASD. Employment*Works*Canada (EWC), offers employment preparedness training and experiential community-based job sampling for young adults with ASD to improve employment readiness and enhance employment skills. This national program is embedded within the community and is gathering practice based evidence.
Objectives:
Our objects were to determine: (1) Did participants' perceptions of their employability skills improve as a result of the program? (2) Did participants' social skills improve as a result of the program?
Methods:
The 60 hour program consists of 24 sessions, delivered twice per week for 2.5 hours over 12 weeks. The first weekly module comprises structured, yet tailored content aimed at employment and social skill building, while the second module focuses on review of the learned concepts, follow-up on homework, and the application of learning through experiential activities in a real work environment. A cohort is comprised of 8 participants with ASD supported by a Program Coordinator and two Program Facilitators.
Two self-report measures were used to evaluate employability skills. The Work Readiness Inventory (WRI; JIST Publishing), The WRI is a 36-item self-report that identifies six areas crucial to work readiness: responsibility, flexibility, skills, communication, self-view, and health and safety. Higher scores on the WRI suggest increased worker concerns or areas of weakness. The Ansell-Casey Life Skills Assessment - Modified (ACLSA-M; Nollan, Horn, Downs & Pecora, 2002), is a strengths-based questionnaire that assesses generalized life skill ability by rating (No, Mostly No, Somewhat, Mostly Yes, Yes) how accurately statements describe current functioning in seven domains (Daily Living, Relationship and Communication, Career and Education Planning, Self-Care, Housing and Money Management, Work and Study, and Looking Forward). The Social Skills Improvement System (SSIS; Gresham & Elliot, 2008), a parent-report questionnaire that measures an individual's ability to perform or acquire social skills using standardized scores (*M*=100, *SD*=15) was used to evaluate overall social skill improvement.
Results:
Eighty-one participants (mean age 22 years) from five provinces completed the EWC program.Â Paired-samples t-tests ($p < .05$) were conducted to evaluate the impact of the intervention. Participants concerns on the WRI significantly ($p< .05$) decreased in all domains by the end of the program suggesting that participation in the program positively influenced participants' perceptions about their work readiness skills (Table 1). Significantly ($p< .05$) more positive scores were noted on the ACLSA-M in the domains directly related to the EWC program, Career and Education Planning, Work and Study, and Looking Forward (Table 2). No significant differences were noted on the SSIS.
Conclusions:
These findings are encouraging in demonstrating benefits of EWC. Employment readiness and support are critical components of sustained engagement of persons with ASD in the labour market. To that end, EWC offers important benefits and promising outcomes.

221 **181.221** Evaluating the Effects of Social Intervention on Social Cognition in Young Adults with High Functioning Autism Spectrum Disorder

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Background: Â Adults with Autism Spectrum Disorder (ASD) and without cognitive impairment (i.e., cognitive intelligence >70) face academic, vocational, psychiatric, physical, social and interpersonal concerns and challenges (Eaves & Ho, 2008; Howlin 2012). There is a lack of effective and available empirically-supported social intervention programs for adults with ASD (Hotton & Coles, 2016), though some programs are emerging. The Program for the Education and Enrichment of Relational Skills, Young Adults (PEERS-YA; Laugeson & Frankel, in press) is a 16-week parent/caregiver-supported, evidence-based, and manualized social intervention using a cognitive-behavioural therapy framework. Although previous studies have shown the program to be effective in enhancing social abilities of adults with ASD and without cognitive impairment, additional outcome measures such as Theory of Mind (ToM) and Trait Emotional Intelligence (TEI), which contribute theoretically and conceptually to one's social and emotional capacities and social-communication challenges (Ferguson & Austin, 2010; Montgomery et al., in press), have not been explored.
Objectives: Â Some critiques to previous studies on PEERS-YA include a limited number and range of outcome measures, the use of only American samples, and a lack of confirmation of participants' diagnostic status. Additionally, few studies have examined long-term effects. The present study aimed to replicate and extend previous findings for young adults who completed the program.
Methods: Â Fourteen young adults (M = 11, F = 3) aged 18 to 28 years old (M = 22.91, SD = 2.99) with ASD and without cognitive impairment, and a parent per young adult were recruited from local agencies and community advertisements. The cognitive ability, diagnosis, EI, ToM, and social skills of the young adult participants were evaluated at four time intervals: 1) baseline (three months before the intervention), 2) pre-test (immediately before the intervention), 3) post-test (immediately following the intervention), and 4) follow-up (three months post-intervention).
Results: Â Outcomes of the program were analyzed and interpreted using the Friedman's test. Parent-reported social skills significantly increased from T1 to T3, T1 to T4, and from T2 to T3. Self-reported social skills scores did not significantly change, although there were median increases in self-reported social skills. Participants self-reported statistically significant increases in ToM from T1 to T3, and T2 to T3; however, ToM performance decreased from T3 to T4. Self-reported TEI was statistically improved from T1 to T4, T2 to T3, and T1 to T3.
Conclusions: Â Findings indicate that PEERS-YA improves parent-reported social skills and young-adult reported TEI at post-test and at follow-up, and ToM immediately after completion of the program. These findings suggest the malleability of one's social cognition and its relation to social skill development. This research points to the ongoing need to continue work in this field and to disseminate services for an aging ASD population.

222 **181.222** Evaluation of Multidisciplinary, Multi-Tiered Approach to Anxiety Treatment in Youth with Autism Spectrum Disorder

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Background:
Anxiety is a commonly seen comorbidity in children and adolescents with autism spectrum disorder (ASD). It is estimated that 40% of individuals with ASD meet criteria for an anxiety disorder with some studies reporting up to 80% comorbidity, which is higher than other clinical populations (van Steesel, 2011; Selles & Storch, 2012). Cognitive behavioral therapy has previously been adapted for ASD and mild to moderate anxiety symptoms with promising results (e.g.Â exposure and response-prevention; Ooi et al, 2008; Wood et al, 2008; Sukhodolsky et al, 2013; Shaker-Naeeni et al., 2014), yet little is known about treatment delivery and efficacy with clients who present with *severe* anxiety symptoms in the context of autism. Seattle Children's Hospital Autism Center (SCAC) developed an Anxiety Program consisting of multidisciplinary care and coordination for children and adolescents with ASD and co-occurring anxiety disorders. The Anxiety Program provides a multi-tiered model of service, incorporating time-limited individual CBT, medication management, and group therapy. This multi-tier service model significantly improved access to care for patients seeking treatment. Additionally, a clinical outcome monitoring system has been implemented to evaluate client progress and program efficacy.
Objectives:
Describe and evaluate the efficacy of a multidisciplinary team approach and multi-tiered model of service for youth with acute anxiety symptoms in the context of autism.
Methods:
A total number of 51 clients were seen by the program receiving an average of 18 individual therapy sessions (*SD*=8.77). A total number of 46 patients (M_{age}=12.1, SD_{age}=2.64) were included in this preliminary analysis. Thirty-nine percentof patients (*N*=18) received medication management, and 32% of patients (*N*=15) participated in at least one round of group therapy. Pre-treatment Clinical Global Impression Severity Scale (CGIS; Guy, 1976) and Multidimensional Anxiety Scale for Children – 2nd Edition Parent Report (MASC2-P; March, 2013) were collected to determine the severity of symptoms. The Clinical Global Impression Improvement Scale (CGI-I; Guy, 1976) were measured for post-treatment clinical improvement. Pre- and post-scores of Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS; Scahill et al., 1997) were analyzed.
Results:
The clinical sample reflects highly acute anxiety symptoms and significant impact on functioning at the start of treatment as indicated by the CGI-S score (*M*=5.19) in the Markedly to Severely Ill range. An average MASC2-P Total Anxiety T score of 72.1 (*N*=16; *SD*=12.06) was in the Very Elevated range. The average post-treatment CGI-I is 2.59, indicating good improvement of symptoms (minimal to moderate improvement), with 36% clients receiving a rating of 1 or 2 (much improved or very much improved). Paired-sample *t* test indicated a significant lower post-treatment CYBOCS score than the pre-treatment score (*t*(4)=4.98, *p*=.008).
Conclusions:
A focused multidisciplinary team approach to treating severe anxiety symptoms among youth with ASD, and a multi-tiered service delivery model appears to reduce symptoms of anxiety as well as improve overall functioning. Additionally, the approach of SCAC's Anxiety Program improves access to care, careful treatment monitoring, and provider satisfaction.

223 **181.223** Evaluation of PEERS® in a Canadian Context: Improvements in Social Skills and Social Competence

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Background: Social impairment is a core feature of Autism Spectrum Disorder (ASD) and has a significant impact on an individual's ability to develop and maintain friendships (Bauminger & Kasari, 2000;Â White & Robertson-Nay, 2009). Social impairment also involves challenges in acquiring discrete social skills and social competence (Usher et al., 2015). Throughout adolescence, social environments become increasingly complex and require the use of more sophisticated skills, making this transition for adolescents with ASD especially difficult (Bellini, 2006). The *Program for the Education and Enrichment of Relational Skills* (PEERS®; Laugeson & Frankel, 2010) is an evidence-based, manualized caregiver-assisted intervention specifically designed for adolescents with ASD that teaches ecologically valid social skills needed to make and keep friends.
Objectives: Existing research on PEERS® has indicated numerous positive outcomes including improvements in social skills, increased frequency of get-togethers, and brain-based changes (Laugeson & Park, 2012; Van Hecke et al., 2013). The current study explored the potential for PEERS®to increase social skills as well as other variables related to social competence within a Canadian context, thus extending previous research findings (Laugeson, 2012).
Methods: Â Participants were 35 adolescents (28 males) aged 13-18 (*M* = 15.9, *SD* = 1.5) with a diagnosis of ASD and intact cognitive abilities (i.e., IQ ≥ 70). Adolescents were recruited from the community and completed the standard PEERS® intervention. Improvements in social skills were measured using adolescent and parent reports of the Social Skills Improvement System (SSIS; Gresham & Elliot, 2008). Social competence was measured using adolescent self-reports of the Social Responsiveness Scale, Second Edition (SRS-2; Constantino & Gruber, 2005). Data was collected prior to the first session and one week after the last session. Results were analyzed using paired sample *t*-tests and Pearson product-moment correlations.
Results: Analyses revealed moderate, significant correlations between caregiver and student responses on measures of social skills in the SSIS, indicating parent and adolescent agreement in social skills ratings. A paired samples *t*-test on pre- versus post-treatment responses revealed significant improvement in social skills as rated by the parents ($p < 0.019$) and the teens ($p < 0.012$) on the Social Skills total score of the SSIS. Adolescents also showed improvement in social competence, as indicated by the SRS-2. Paired samples *t*-test on pre- versus post-treatment responses revealed significant improvement in SRS-2 subscales of Social Awareness, Social Cognition, Social Motivation, and Social Communication ($p < 0.05$).
Conclusions: These results provide cross-cultural support for PEERS® and corroborate existing research findings which indicate that PEERS® increases adolescents' overall social skills and social competence in the areas of social awareness, social cognition, social motivation, and social communication. Future research assessing long-term maintenance of acquired social skills within a Canadian population is needed.

224 **181.224** Evaluation of Performance-Based Measures of Functional Skills

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Background: Valid outcome instruments that produce reliable scores and are capable of detecting change are an essential component of research, treatment and program evaluation. Given that interventions for children with Autism Spectrum Disorder (ASD) are often intended to develop functional skills, outcome instruments that are valid indicators of these skills, and that reliably evaluate treatment effects are important. Towards this end, parent-reported outcomes are often obtained, and although they provide important information about function, they may be subject to response bias. Thus, performance-based outcome instruments that objectively evaluate functional skills are needed to supplement parent-reported outcomes, and to support the rigorous and systematic evaluation of interventions for children with ASD.
Objectives: The purpose of this study was to identify performance-based instruments of Activities of Daily Living (ADLs) and socialization, evaluate their psychometric properties, and determine feasibility for use in intervention trials for ethnically diverse children with ASD ages 6-9 years.
Methods: Â This study used mixed methods to achieve its objectives. First, a systematic approach was used to review research and literature to identify performance-based assessments of ADLs and socialization. Assessments were included in the review if they: 1) evaluated ADL's and/or socialization; 2) included normative data for children with ASD ages 6-9 years of age; and 3) were performance-based, with evidence of psychometric support.Â Next, a panel of experts used a 32-point quality indicator scale designed specifically to assess the quality of outcome instruments and to rate psychometric properties, utility, and appropriateness for ASD (Law& MacDermid, 2014; Portney & Watkins, 2009). Using a Modified Delphi Technique, the highest rated instruments were further assessed to identify the two strongest instruments. These two instruments were then administered to 20 ethnically diverse children with ASD to evaluate feasibility, utility and discriminative validity.
Results: Â Seven performance-based outcome measures of ADL's and Socialization were identified and rated. Modified Delphi Technique identified the top-rated instrument for ADL's as The Assessment of Motor and Process Skills (AMPS – Fisher& Jones, 2012) and for socialization, The Evaluation of Social Interaction (ESI - Fisher and Griwold, 2010). Both instruments were successfully administered to 20 children with autism in one hour or less demonstrating feasibility and utility. Discriminant validity testing using the standardized canonical discriminant function coefficient showed that the AMPS Process Score predicted the ADOS Autism Severity score (r = -.63) such that a high AMPS Process score predicted low ADOS severity (as hypothesized). The AMPS Motor score was a moderate predictor (r =.445). The ESI was a strong predictor (r=.84) but in the opposite direction expected.
Conclusions: Â The AMPS shows promise as a performance based outcome measure of ADL's having strong psychometrics and feasibility for administration to children with ASD. Preliminary data suggests that the AMPS shows adequate discriminant validity. While the ESI shows strong psychometrics, utility and feasibility, further assessment of discriminant validity is needed. Implications of these findings for research and practice will be discussed.

225 **181.225** Evaluation of a Peer Education Program about Autism Spectrum Disorder for Elementary School Students

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Background: Â The increased identification of students with autism spectrum disorder (ASD) has implications for public education as access to general education and instruction in the least restrictive environment are legal rights. Approximately 30-40% of elementary school students with ASD receive at least some of their instruction in general education settings. As such, students with ASD and typically developing peers will likely encounter each other during school hours. The practice of inclusive education for students with ASD is based upon protecting children's educational rights and, in part, improving social acceptance. Despite the potential social benefits of inclusion, students with ASD often experience limited social interaction, loneliness, social isolation, and bullying. The Kit for Kids (KfK) was developed by the Organization for Autism Research (OAR; see Figure 1) in order to provide evidence-based educational messages to elementary school students to improve peers' knowledge, initial attitudes, and behavior towards students with ASD.
Objectives: Â Investigators evaluated the impact of the KfK program on elementary school students' knowledge of ASD and attitudes towards an unfamiliar student. Our two research questions were: (a) Does the KfK program increase elementary school students' knowledge of ASD? and (b) Does the KfK program increase elementary school students' attitudes towards an unfamiliar student with ASD?
Methods: Â A total of 107 4th and 5thgrade students were randomly assigned to receive the KfK program or not prior to viewing a videotape of a student with ASD. Students completed two measures after viewing the videotape: (a) Knowledge of Autism (KOA; 16 items, □ = .55), a general measure of knowledge of ASD; and (b) a modified version of the Children's Attitudes towards Children with Handicaps (CATCH-A; 36 items; □ = .93), a measure of attitudes about the student with ASD. One week later, controls received the KfK program and completed measures about the videotaped student while treatment participants completed measures about the student a second time.
Results: Two, 2 (Time) by 2 (Condition) mixed-model ANOVAs revealed significant time by condition interactions for knowledge, $F(1, 99) = 19.28$, $p < .001$, = .16, and attitudes, $F(1, 90) = 8.62$, $p < .01$, = .09. The treatment group reported higher knowledge than control group immediately after intervention, $t(103) = 2.65$, $p < .01$. The control group reported more knowledge after receiving the intervention, $t(53) = 5.17$, $p < .001$. Attitudes did not differ between groups immediately after the intervention (i.e., at Time 1); however, the control group reported more favorable attitudes after receiving the intervention, $t(46) = 2.11$, $p < .05$. Treatment group attitudes declined from intervention to follow-up, $t(44) = -2.04$, $p< .05$.
Conclusions: The KfK program resulted in increased knowledge of ASD for elementary school students. The KfK program resulted in improved attitudes over time; however, attitudes declined over a one-week period. The KfK results in improved knowledge and attitudes in an analogue experimental design; future evaluation should consist of testing the materials with actual students with ASD included in elementary school classrooms.

226 **181.226** Examining the Effects of the PEERS® Social Skills Intervention on Racial and Ethnic Minorities with Autism Spectrum Disorder

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Background: There is limited research examining the effects of a social skills intervention on racial and ethnic minorities with autism spectrum disorder (ASD). Most research studies examining interventions with individuals with ASD are disproportionately non-Latino Caucasian or do not separately examine different racial and ethnic minorities (Lord et al., 2005).
Objectives: The goal of the current study was to examine if the effects of the PEERS® intervention differ among racial and ethnic groups in comparison to non-Latino Caucasian individuals with ASD.
Methods: One hundred and eighty-three (*N* = 183) individuals with ASD aged 11 to 28 participated (M_{age} = 15.2, sd = 3.5); nine identified as Asian, 11 as African American, eight as Latino, 152 as non-Latino Caucasian, and three individuals identified as Hawaiian/Islander, Middle Eastern, and Biracial/Multiracial, and were grouped together as "Other". A randomized controlled trial design was used to examine the effects of PEERS® and PEERS® for Young Adults, parent/caregiver-assisted interventions focused on improving social and friendship skills (Experimental, *n* = 92; Waitlist, *n* = 91). Adolescents and young adults completed the Test of Adolescents Social Skills Knowledge (TASSK; Laugeson et al., 2012) and the Test of Young Adults Social Skills Knowledge (TYASSK; Gantman et al., 2012), respectively at pre- and post-intervention. The TASSK/TYASSK were used to assess social skills taught during PEERS®. Parents or primary caregivers completed the Social Responsiveness Scale (SRS; Constantino et al., 2003) and the Social Skills Improvement Scale-Revised Scales (SSIS-RS; Gresham & Elliott 2007) at both time points, which were used to measure autism-related behaviors and social skills, respectively.
Results: Preliminary analyses were conducted to examine possible group differences by race/ethnicity on demographic variables; no significant differences were found. Repeated measures ANOVAs were conducted for Time (Pre, Post) by Group (EXP, WL) by Race/Ethnicity (Asian, African American, Latino, Caucasian, Other) for each outcome measure. When analyzed by group, no significant difference was uncovered for response to treatment based on race/ethnicity on the TASSK/TYASSK ($F(4,172) = .411$, $p = .801$), SRS ($F(4,160) = 1.600$, $p = .177$), or SSIS-RS ($F(4,169) = 1.229$, $p = .301$). There was a significant difference between EXP and WL improvement on the TASSK/TYASSK ($F(1,182) = 283.542$, $p < .001$), SRS ($F(1,170) = 16.720$, $p < .001$), and SSIS ($F(1,179) = 7.689$, $p = .006$).
Conclusions: The present study provides preliminary evidence that PEERS® is as efficacious for racial and ethnic minority groups as non-Latino Caucasian adolescents and young adults with ASD. Although some research has demonstrated differences among minority compared to majority groups in autism-characteristics (Tek & Landa, 2012; Blacher et al., 2014; Gourdine & Algood, 2014) and shown different cultural interpretations of autism symptoms (Dyches et al., 2004; Bernier et al., 2010; Tincani et al., 2009), racial and ethnic minority groups in the present sample showed the same benefits in response to a social skills intervention as non-Latino Caucasian individuals. These findings are an important addition to the limited research about the effects of social skills interventions on racial and ethnic minorities with ASD.

227 **181.227** Expert Provider Use of Empirically-Evaluated Treatment Elements for Anxiety in Youth with ASD

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Background: The research-to-practice gap is a well-established phenomenon and extends to treatments for youth with autism spectrum disorders (ASD; e.g., Brookman-Frazee, et al., 2010). ASD, relative to typically-developing youth, are at increased risk for anxiety (van Steensel et al., 2011). There has been a growing interest in the study of efficacious anxiety treatments for individuals with ASD (Danial & Wood, 2013); however, dissemination of these treatments has been limited (Reaven et al., 2014). In order to identify the size and scope of the research-to-practice gap for the treatment of anxiety in ASD, use of empirically-evaluated treatment elements by expert community providers must be examined.
Objectives: The primary purpose of this study was to examine the extent to which expert, community providers are using the most and least empirically-examined treatment elements to treat anxiety in ASD youth.
Methods: We conducted a comprehensive literature search, and reliably coded articles (*N*= 48) for anxiety (excluding OCD) treatment elements (ICC(2,5)=.792). Fifty elements were identified from included articles. For analytical purposes, elements were then sorted into 8 categories ranging from the least (group 8) to most (group 1) frequently used treatment elements (see Figure 1). Groups were divided to provide closest match possible to the frequency distribution in the literature while balancing statistical power. Next, 53 expert providers (primarily treating ASD youth for ≥5 years, and ≥50 ASD youth over the last 5 years) participated in a national, multi-site survey, rating these 50 treatment elements in terms of their frequency of use to target anxiety
Results: Â A one-way ANOVA revealed significant differences in provider ratings of frequency of use of element groups, $F(1,7) = 3.42$, *Â* $p = .006$. Pairwise comparisons between element groups revealed that providers reported using elements in group 1 more often than those in groups 6, 7, and 8 (p's ≤ .005). Next, a repeated-measures ANOVA was conducted to identify differences among strategies within the top and bottom groups. Within group 1, graduated exposure and visual supports were used significantly more by providers than self-management and didactic teaching (p's < .05; see Figure 2A); while within group 8, providers used peer-monitoring significantly less than all other strategies (p's < .05; see Figure 2B).
Conclusions: Â Expert providers in usual care settings are largely using empirically-examined treatment elements to treat anxiety in youth with ASD. Thus, their expertise may be important for identifying clinical variables relevant to treatment elements that have not yet received empirical examination. Toward this end, a "two-way bridge" initiative (Goldfried et al., 2014), which promotes dissemination of clinical experiences to researchers and vice versa, rather than solely relying on the researchers, may be useful for narrowing the research-to-practice gap. In this context, observational studies of treatment elements in usual care settings would augment provider-reported element use. Moreover, whether these frequently used elements are efficacious remains to be seen. Thus, future "two-way" bridge initiatives could focus on evaluating outcomes associated with implementation of these treatment elements in usual care settings, which would pave the way for targeted dissemination efforts.

228 **181.228** Fostering Socio-Emotional Competencies in Children with Autism Spectrum Condition: Results of a Randomized Controlled Trial Using the Interactive Training App „Zirkus Empathico"

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Background:
Given that access to specialist Autism Spectrum Disorder (ASD) service does not meet needs, computer-based interventions offer a cost-effective solution to the problem. Few treatments, especially for socio-emotional competencies, have, however, been rigorously evaluated and could produce improved skills beyond those directly targeted by the intervention.
Objectives:
This study seeks to evaluate the acceptance and effectiveness of „Zirkus Empathico“, a tutor-guided app fostering socio-emotional competencies in pre-school and elementary school children with ASD in a registered, randomized controlled trial (RCT). „Zirkus Empathico“ includes four training modules focusing on i) recognition and verbalization of own emotions, ii) recognition of other's emotions from facial emotions and iii) context films, iv) emotional empathy and prosocial behavior, and v) generalization into daily life via interactive animations, which aid the communication of own and other's emotions.
Methods:
We are conducting a multicenter RCT: Manualized tutor-guided „Zirkus Empathico" (6 weeks with a minimum of 100 min./week) versus an active control group using educational apps not focusing on socio-emotional functions for the same amount of time at three points of assessment (baseline, post training, 3 months follow-up) in children aged 5-10 with high-functioning ASD. N=150 individuals were assessed for eligibility, of which 82 were randomized to participate in the trial. Participants diagnosed with ASD according to ICD-10 criteria, corroborated by ADOS, and have IQ>85. Training takes place at three university centers in Germany and Austria. Parent report Social Responsiveness Scale (SRS) and Griffith Empathy Measure (GEM) ratings serve as outcome measures.
Results:
Preliminary analyses of 36 children that completed the trial show high acceptance, as indicated by low drop-out rates of 2%. Results from repeated measures ANOVA for parent SRS and GEM ratings show significant effects of "Zirkus Empathico" compared to the control intervention on SRS total score, and SRS subscales social motivation, social cognition, and social communication at follow-up. In addition, significant effects were shown on GEM total score and GEM subscore affective empathy (all $p < .05$).
Conclusions:
The findings indicate that "Zirkus Empathico" has high acceptance among children with ASD and leads to improvements in social communication and behavior as well as empathy in affected children. Results of the completed trial as well as moderator analyses for sex, age, ASD symptom severity, and IQ will be reported at the conference.

229 **181.229** Good Practices in Youth Intervention in Autism Spectrum Disorder: A Program to Improve the Social Skills

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Background:
People with ASD have persistent deficits in communication and social interaction in different contexts and patterns of behavior, interests and activities restricted and stereotyped (DSM-V, 2013). Studies such as Theory of Mind (Baron - Cohen, 1985) show that people with ASD and other disorders have difficulty inferring mental states of other people affecting their abilities and social skills.
Objectives: People with autism need to learn these skills explicitly make a detailed study and fragmented social relationships because their inability to "read the mind" prevents them from understanding the behavior of others. To respond to these difficulties, implemented an intervention project to work and improve emotional and social skills of adolescents with ASD or low emotional and social skills
Methods:
Sample: Five young people with ASD or other disruptions in the area of social and emotional development between 17-21 years.
Methodology: The project begins with a study of the needs of young people with difficulties in marked areas and socio-emotional. From there, you design a program of social skills with a previous emotional education enough in learning theory and principles of cognitive therapy - behavior.
Duration: months November to April with a two-hour weekly session.
Evaluation: interview, observation, teens-2, WAIS-IV, Vineland, assessment scales of HHSS. Re-test.
Results: the social skills of the sample improved
Conclusions:
The social skills training improve the skills of these people with ASD.

230 **181.230** Group-Delivered Video Model Intervention Package Improves Social Skills in Adults with Autism Spectrum Disorder

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Background: Video modeling (VM) is an evidenced-based intervention proven effective in improving social skills in children and adolescents with autism spectrum disorder (ASD) (Shukla-Mehta et al., 2010; Day-Watkins et al., 2014). Few reports have been published on the development of VM services suitable for adults beyond their early twenties (Cappadocia & Weiss, 2011; Williams et al., 2007). As part of a pilot study of a new cognitive behavioral treatment program, Training to Understand and Navigate Emotions and Interactions (TUNE In), we developed a VM package to train social skills to adults with ASD.
Objectives: To use VM, role-play, and feedback to teach 13 adult participants with ASD four fundamental social skills. The goal of the study was to extend the VM literature to teaching specific social skills to adults with ASD to examine the efficacy and feasibility of delivering the social skills interventions to an adult population and in community behavioral health settings.
Methods: Across eight weekly sessions, participants were taught to engage in four different social skills (e.g. approach a group (skill 1); don't approach a group (skill 2); greet a group (skill 3); and initiate conversation (skill 4)). During sessions facilitated by behavioral coaches, participants role-played with actors (i.e. undergraduate research assistants) on five exemplars of each social skill. The actor engaged in scripted scenes (discriminative stimuli) of each social skill exemplar, setting the occasion for the participant to respond by either demonstrating or not demonstrating the appropriate skill. Baseline data on responses was collected in week 1. In week 2, skills 1 and 2 entered *treatment*, while skills 3 and 4 remained in baseline. During *treatment*, if participants responded incorrectly, they were given a video model depicting an individual correctly engaging in the target skill. After access to the video model, participants repeated role-play trials, and feedback was provided on steps completed correctly and incorrectly. In week 3, training on skill 3 began and training on skill 4 began in weeks 4. Generalization probes were interspersed between training trials. Training on each social skill was staggered across four weeks to assess for the emergence of correct responding to the generalization probes, which had not yet received training with a video model.Â Paired t-tests were used to compare participant scores from final baseline measurements vs. week 8 measurements.
Results: All participants' scores increased from final baseline measurements to week 8 (Figure 1). (*Skills 1-3 $p<0.001$; Skill 4 $p<0.003$*).
Conclusions: Participants demonstrated a significant increase in correct responses for each social skill after receiving this VM intervention package. These data demonstrate the effectiveness of VM of social skills across multiple participants and multiple skills. This group delivery model is critical for the dissemination of behavioral and mental health services to sites where large consumer populations and limited resources don't allow for the delivery of intensive, individualized intervention to individuals with ASD.

231 **181.231** TUNE in, a Novel Cognitive Behavioral Treatment Program to Improve Social Functioning in Adults with ASD: Pilot Study Results

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Background: Â In the coming decade, approximately 600,000 children with autism spectrum disorder (ASD) will reach adulthood in the United States. They, and the several million adults currently diagnosed with ASD, will need ongoing services and support. However, there are few evidence-based treatment programs for adults with ASD beyond their early twenties to improve social functioning, a key factor in adults' employment, relationships, and overall quality of life (Howlin, Moss, Savage, & Rutter, 2013; Shattuck et al., 2012). We developed an, integrated three-part intervention, TUNE In (Training to Understand & Navigate Emotions and Interactions), which targets the multiple behavioral domains underlying social functioning (social motivation, social anxiety, social cognition, social skills) in adults with ASD, and has components to generalize new social understanding and social skills to community settings.Â By targeting all of these domains, we hypothesized that TUNE In would improve overall social functioning.
Objectives: To preliminarily assess the effects of TUNE In on social functioning in adults with ASD.
Methods: Twenty-nine adults were enrolled and assigned to either immediate treatment (Cohort 1) or delayed treatment (Cohort 2) conditions (Table 1). TUNE In consists of 17 weekly sessions divided into three consecutive components: 1) five one-on-one sessions addressing social motivation and anxiety through cognitive coaching and mindfulness exercises; 2) eight group sessions addressing social cognition through a didactic curriculum, and addressing social skills through video modeling; 3) four sessions addressing generalization of skills to community settings by having participants engage in a philanthropic volunteer work team. To date, participants in both groups underwent assessments of social functioning at two time points: baseline (Time 1) and again after Cohort 1 completed treatment but before Cohort 2 started treatment (Time 2). Cohort 2 has now started treatment, after which data will again be collected from both groups at Time 3. We used the Wilcoxon Rank Sum Test to test the hypothesis that there would be a significant difference between the "immediate treatment" group (Cohort 1) and the "delayed treatment" group (Cohort 2) in percent change in two measures of overall social functioning—the Social Responsiveness Scale-2 (SRS-2) and the Social Network Index - People in Social Network Subscale (SNI; Cohen, 1991)—between Time 1 and Time 2.
Results: Â Seven participants in Cohort 1 completed TUNE In and are compared with the 13 participants in Cohort 2 (delayed treatment group). Evidence of significant social functioning improvements from Time 1 to Time 2 were observed in Cohort 1 but not in Cohort 2, as reflected in percent change in the SRS-2 and SNI.
Conclusions: These pilot data suggest there are benefits to the integrated service strategy of TUNE In that targets multiple behavioral domains underlying social functioning and provides opportunities for skill generalization. Data to be collected at Time 3 will enable us to assess effects in Cohort 2. Further study of TUNE In is warranted in order to address the urgent need for evidence-based treatment options targeting social functioning in adults with ASD.

232 **181.232** Identifying Active Ingredients: Examining the Relationship Between Teacher Fidelity of Implementation of Classroom Pivotal Response Teaching and Student Engagement

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Background:
ASD interventions are complex and generally composed of multiple components targeting skills across several domains. When using packaged interventions, teachers have reported difficulty in utilizing all components effectively (Stahmer, Suhrheinrich, Reed, & Schreibman, 2012). To date, there is little research examining the individual components of multi-component interventions and how they influence student behavior and outcomes. Identification of the active ingredients in interventions may allow for streamlined, more efficient intervention protocols. Classroom Pivotal Response Teaching (CPRT) is a multi-component behavioral intervention developed for use in classroom settings for students with ASD. Close examination of how teachers' use of CPRT relates to student behavior may provide valuable information on how the protocol may be optimally utilized in classroom settings.
Objectives:
The objective of the current project is to examine the relationship between student active participation in learning activities and teachers' fidelity of implementation (FI) of CPRT. Results may inform which components of CPRT are necessary to best promote student engagement.
Methods:
99 special education teachers (94% female) in the greater San Diego area received training in CPRT as part of a randomized trial of the intervention. All teachers supported at least one student with an educational classification of autism. Classroom observations were recorded at multiple time points before, during and after CPRT training during regular classroom activities. Observations were coded using two separate coding systems to evaluate: 1) teachers' FI of CPRT and 2) child engagement in the activity. Fidelity measurement involved rating each teacher on 19 CPRT components using a 5-point Likert scale (1 = does not use, 5 = uses throughout). Student engagement in the activity was continuously coded using observational coding software. Correlations between teacher fidelity on individual components of CPRT and student engagement was examined across all videos.
Results:
Based on nearly 200 video observations thus far, preliminary results indicate that higher student engagement is associated with decreased use of turn taking, motivating materials, direct reinforcement, and reinforcement of good trying strategies by teachers. An additional 300 video observations are being examined to further explore these preliminary relationships, as well as allow for more complex analyses that address questions of prediction. Furthermore, the relationship between fidelity and student characteristics such as ADOS severity scores and communication skills will also be assessed.
Conclusions:
Data suggest that student engagement is related to teachers' fidelity to CPRT strategies. Although current analyses do not allow for interpretation of the direction of influence, a possible explanation is that teachers may be implementing fewer motivational components of CPRT when students are more actively engaged. Teachers may not see a need to take turns or incorporate motivating materials when the students are actively participating. However, if students are consistently engaged without these components present, this is valuable information for determining the active ingredients of multi-component interventions such as CPRT. Further analyses will continue to address the question of active ingredients and student characteristics as a predictor of engagement in order to promote efficient and effective use of the intervention in classroom settings.

233 **181.233** Ifit: A Peer-Supported Physical Activity Program for College Students with ASD

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Background: There is growing evidence that individuals with Autism Spectrum Disorder (ASD) experience deficits in the motor domain, which may prevent them from leading an active lifestyle. Healthy People 2020 recognizes participation in physical activity (PA) as a leading indicator of health, and it is recommended that adults meet the national guidelines of 150 minutes of moderate to vigorous intensity PA each week. Yet meeting this recommendation is rarely achieved in youth and adults with ASD. With such high prevalence rates of ASD, it is critical to develop evidence-based interventions that increase levels of PA and physical fitness before chronic health issues become a major burden for individuals, families, and public health.
Objectives: The aim of this study was to increase time spent in PA and encourage college students with ASD to participate in regular exercise. Specifically, we set out to examine the effects of a PA program on: (1) levels of physical fitness (1-mile walk, sit-ups, push-ups, and sit and reach), and (2) psychosocial wellbeing (anxiety symptoms) of young adults with ASD.
Methods: IFiT (Into Fitness Together) is a 10-week, individualized peer-mentored PA program tailored to address the motor and social barriers to PA among college students with ASD. Eleven male college students with ASD and 11 college Kinesiology majors (peer mentors) participated in the program. Students with ASD were paired with a peer mentor. Dyads met twice a week for 10 weeks for a minimum of 120 minutes of PA of their choice and 30 minutes to plan activities for the coming week, including 30 minutes of individual exercise. Anthropometric, fitness, and anxiety measures were taken pre- and post-intervention. Fitness measures included the timed 1-mile walk to provide an estimate of aerobic capacity, sit-ups and push-ups for muscular strength and endurance, and the sit and reach test for assessing flexibility. Self-reported anxiety was assessed using the Beck Anxiety Inventory.
Results: Cardiovascular endurance, as measured by the timed 1-mile walk, significantly increased from pre- (M = 41.19) to post-intervention (M = 49.13), $t(10)$= 12.26, p < .01. Muscular strength as measured by push-ups increased significantly from pre- to post-intervention (M = 7.33, M = 11.22, respectively), $t(10)$=7.33, p < .05. The sit and reach results were also statistically significant showing gains in flexibility from pre- (M = 12.45) to post-intervention (M = 15.23), $t(10)$= 3.79 p < .05. There were no significant changes from pre- to post-test for muscular endurance or anxiety. Adherence to the program was 96.17%.
Conclusions: College students with ASD increased their fitness levels after participating in a 10-week, peer-mentored PA program. Participants engaged in a variety of activities, attended on a regular basis, and reported enjoying the program. IFiT is a fun, accessible, and low-cost program that holds much promise for increasing PA and fitness amongst young adults with ASD, who generally do not meet the national guidelines for PA. The peer-mentor model may have contributed to the success of the program.

234 **181.234** Improvements in Emotional Intelligence Following Completion of PEERS® in Adolescents with Autism Spectrum Disorder

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Background: Emotional intelligence (EI) refers to the ability to understand oneself, relate to others, and adapt to variable environmental demands (Bar-On & Parker, 2000). Research has identified EI as a key component of social competence and is related to quality of social interactions (Ferguson & Austin, 2010; Lopes, 2003). Given the significant impairments in social and emotional functioning observed among individuals with Autism Spectrum Disorder (ASD) (Brady et al., 2014; Petrides et al., 2011), further investigation on the relation between EI and social skills is warranted. Individuals with ASD who have intact cognitive ability could benefit from interventions targeted at improving their social and emotional functioning. Therefore, it is important to identify effective interventions that target these problem areas.
Objectives: Limited research has examined the effect of the *Program for the Education and Enrichment of Relational Skills* (PEERS®; Laugeson & Frankel, 2010) on EI in adolescents with ASD. PEERS® is a 14-week evidence-based, caregiver-assisted social skills intervention designed to help adolescents with ASD make and keep friends. The aim of the current study was to investigate the effect of participation in PEERS® on EI in adolescents with ASD.
Methods: Participants were 32 adolescents (27 males) aged 13-18 (M = 15.9, SD = 1.5) with a diagnosis of ASD and intact cognitive functioning (i.e., FSIQ ≥ 70). Adolescents were recruited from the community and completed the standard PEERS® intervention. Improvements in social skills were measured using adolescent self-reports and parent reports of the Social Skills Improvement System (SSIS; Gresham & Elliot, 2008). EI was measured using the BarOn Emotional Quotient Inventory: Youth Version (EQ-i:YV; Bar-On & Parker, 2000). Data was collected both pre and post intervention and was analyzed using paired samples t-tests and Pearson product-moment correlations.Results:
Results: Results indicate that adolescents demonstrated significant improvements in overall EI (p<.05) as well as significant improvements in the intrapersonal, adaptability, and stress management domains of the EQ-i:YV (p<.05). Results also revealed significant improvements in social skills as rated by parents (p<.05) and adolescents (p<0.5) on the SSIS. Overall EI was significantly correlated (p<.05) with both self and parent ratings of social skills on the SSIS (r=.66, r=.51, respectively) prior to starting the intervention. Post-intervention overall EI significantly correlated (p<.001) with self-reported ratings (r=.79), and approached significant correlation for parent ratings (r=.33, p=.067).
Conclusions: These findings suggest that participation in PEERS® may improve EI in adolescents with ASD. Further, significant improvements in EI were related to improvement in social skills. Given the impact of social and emotional deficits in this population, the results represent an important contribution to our current understanding of the relation between EI and social skills in adolescents with ASD. Future research should examine long-term effects of PEERS® on EI to assess maintenance of improvements.

235 **181.235** Improving Amount of Detail and on-Topic Question-Asking in Adults with ASD Using a Visual Framework and Self-Management

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Background: Research shows promise that behavioral interventions can improve social conversation in adults with Autism Spectrum Disorder (ASD). Additionally, research demonstrates that individuals with autism may have strengths in visual processing, and incorporating visual strengths into behavioral interventions may lead to improvement. Self-management techniques that teach multiple communicative behaviors (such as question asking and amount of detail) using a visual component have been shown to lead to improved reciprocal conversation in children with ASD, but it is unclear if this type of intervention can improve these skills in adults.
Objectives: The purpose of the current study is to see whether this type of intervention will lead to empirically measurable improvements in both rates of question-asking and appropriate amount of detail.
Methods: Participants included three adults between the ages of 25 and 42 years diagnosed with ASD according to DSM-5 criteria. Participants demonstrated significant impairments in social communicative functioning level and social competence. A multiple baseline design across participants was used to assess the effects of the self-management intervention program on participants' amount of detail and question asking. During intervention, the visual framework outlined a conversational turn, which is defined in the framework as responding to the question, adding 1-3 details to the response, then asking an on-topic question. There were 10 boxes on the visual framework in which the participant self-managed their conversation points for successfully completing both components. Conversation probes with novel peers were collected every three sessions in conditions similar across baseline and intervention. Dependent measures included (1) *appropriate amount of detail*, defined as 1-3 supplemental pieces of information that is on-topic, focused, and relevant to the conversation; and (2) percentage of *number of on-topic questions*, defined as any question that elicits new information from conversational peers that is on-topic and relevant to the conversation.
Results: Preliminary results indicate that all participants improved their amount of detail and percentage of on-topic questions in the context of a multiple baseline design. Specifically, Participant 1 increased from a mean percentage of appropriate amount of detail from 33% of intervals to 70% of intervals and increased percentage of on topic questions asked from 5% to 36% of the total conversation. Participant 2 increased from a mean percentage of appropriate amount of detail of 57% of intervals to 92% of intervals and increased mean percentage of on topic questions asked from 17% to 31%. Participant 3 increased from a mean percentage of appropriate amount of detail from 61% of intervals to 88% of intervals and increased mean percentage of on topic questions asked from 27% to 39% of trials. These preliminary data show medium to large effect sizes. Generalization data will be collected one month after completion of the intervention.
Conclusions: Preliminary results show promise that this type of intervention may be effective in improving amount of detail and number of on-topic questions among adults with ASD. The results suggest that future research on improving reciprocal conversation in adults with ASD may be highly profitable.

236 **181.236** Improving Engagement on the Playground and in the Classroom for School Age Children with ASD: A Multisite Randomized Trial

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Background: Impairment in social interaction has been recognized as a critical issue for children with autism spectrum disorder (ASD). Several interventions, implemented by research staff, improved child social outcomes in schools. However, little is known about the effectiveness of these interventions when delivered by paraprofessionals, especially the paraprofessionals who spend the most non-instructional time with these children.
Objectives: This study aimed to evaluate the efficacy of a social skills intervention, Remaking Recess (Kretzmann, Locke, & Kasari, 2012), on peer engagement and social network salience for children with ASD using a multi-site, randomized, wait-list-controlled design when implemented by paraprofessionals.
Methods: Eighty children with ASD (age 5-12 years) in grades K-5 recruited from three sites were randomized to Remaking Recess (RR: n=39) or a waitlist (WL: n=41) for 3-months with a 1-month follow-up.
Intervention (Remaking Recess): Paraprofessionals work with research staff over 3 months, held during children's non-instructional time. Sessions consist of information sharing, active coaching, and systematic support. Paraprofessionals were trained with an hour-long group presentation on the social challenges of children with ASD at school and overview of the Remaking Recess intervention and then provided daily active coaching on the playground for twoÂ weeks (8-10 sessions). The researcher provided consultation for 6-8 more sessions over the next 6Â weeks and completely faded consultation and coaching for the last twoÂ weeks.
Measures: The Playground Observation of Peer Engagement is an interval coding system that identifies durations of joint engagement with peers or solitary play. The Friendship Survey is a questionnaire used to assess children's friendships and social networks of peer relationships in the general education classroom. All measures are collected at pre/post intervention and at the 1-month follow-up.
Results: Percentage of time spent in solitary engagement was modeled using the hurdle model (i.e. binary and truncated Gaussian). There was a significant overall treatment difference in the truncated Gaussian model ($F(1,76)=4.01$, $p=0.049$) from pre-treatment to post-treatment, but not in the binary model ($F(1,76)=0.48$, $p=0.492$). This showed that for those children who spent more time in solitary engagement (i.e. those who crossed the hurdle), the children in the RR group showed significantly more reductions in time spent in solitary play from pre-treatment to the post-treatment compared to children in the WL group.
There was no significant treatment difference or overall change in time from pre-treatment to post-treatment ($F(1,67)=0.30$, $p=0.58$ and $F(1,67)=0.45$, $p=0.50$ respectively) in social network salience within the classroom. However, there was a significant treatment difference from pre-intervention to follow-up ($F(1,118)=1.97$, $p=0.05$) where children in the Remaking Recess group, on average, became more salient in their classroom from pre-intervention to follow-up compared to the children in the WL group.
Conclusions: These results suggest that a low dose, brief, and paraprofessionals mediated intervention conducted in schools can be beneficial in increasing peer engagement and classroom salience for children with ASD in inclusive settings. The benefits of Remaking Recess may require more time in order for children with ASD to become more engaged on the playground and salient in their classroom.

237 **181.237** Inclusion-Focused University-Based Community Integration Programs: A Pilot Study of Perceived Benefits By Participating Adults with Autism

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Background: Adults with autism often experience challenges with successfully and meaningfully integrating into their communities (Roux et al., 2015). These challenges affect many aspects of quality of life. Adult-focused approaches to supporting various skills that can enhance quality of life are limited. Similarly research on effective approaches to facilitate greater community integration is minimal (Hendricks & Wehman, 2009; Scheeren & Geurts, 2015).
This Center offers programs that are fully inclusive—bringing together adults with autism and students as peer mentors from a wide variety of majors. Programs focus on enhancing opportunities for adults with autism to live as fully engaged members of their communities. Students enrolled in an undergraduate core course with a 20-hour service learning component engage collaboratively with adults with autism ("participants") in group programs under the supervision of faculty/staff instructors. Each program has similar numbers of adults with autism and student peer mentors and meets for 1-2 hours once or twice a week for 10 weeks during a semester. Programs such as fitness, art, comedy/improv, dance, yoga, men's and women's groups emphasize one or more of five key areas: self-advocacy, self-expression, self-regulation, problem solving and decision making, and team work/collaboration.
Objectives: To assess the participants' perceptions of 1) benefit from peer-to-peer interaction with the students; and 2) benefit of the program in addressing key areas for community integration.
Methods: Â Post-program surveys were distributed to all participants enrolled in Fall 2015 and Spring 2016 programs. Total enrollments across the 15 programs that had undergraduate students as peer mentors were 115. Surveys were completed independently or with parent/guardian/other adult support to record feedback, and returned via mail or through a drop-box at the center. A total of 57 surveys were returned (49.5% return rate).
Results: All participants indicated that they benefited by having student peer mentors engaged in their programs. Participants rated students as being helpful in completing tasks or activities (52.6%), improving communication skills (50.9%), improving teamwork skills (43.9%), expanding knowledge of interests or activities (40.4%), and helping with problem solving (36.8%). They reported the students as having positive attitudes (93%), being helpful (82.5%), and interested in talking with them (71.9%). Participants indicated that they benefited by "meeting new people" and "having people [their] age [they] could talk to." Across the programs, around 40% of the participants' comments specified social aspects of the programs as the "best thing" about the program, including "interacting with my mentors," being treated as an "equal," "social interaction," and "students' company." Participants also reported wanting to learn - and subsequently learning the most about - social skills, self-expression, and team work in their programs.
Conclusions: Adults with autism reported that the programs helped them gain skills they deemed were important. Participants also had very positive perceptions of the peer-to-peer interactions they experienced and identified specific benefits from peer-engagement. Further research is needed to determine if the impact of these programs remains over time, especially in these areas: social skills, self-expression, team work and high community engagement.

238 **181.238** Increasing Motivation in Academics for Children with Autism in Inclusive Classrooms

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Background: Many children with ASD show little to no interest in academic assignments that are challenging or uninteresting. This may lead to increases in disruptive behavior in order to avoid or escape the non-preferred tasks. By incorporating motivational components of Pivotal Response Treatment in homework tasks, previous studies found faster completion rates, decreases in disruptive behavior, and improved interest (Koegel, Singh, Koegel, 2010).
Objectives: This study looks to determine if using motivational components during academic tasks will increase child affect, interest, and percentage of correct answers in an inclusive classroom environment.
Methods: An alternating treatment design was employed to assess the effectiveness of two different conditions (i.e., standard worksheet condition and motivation/natural reinforcer condition). The standard worksheet condition consisted of an everyday worksheet that was assigned to the whole class. These worksheets were repetitive and included tasks such as identifying and writing letters and sight words. The motivation/natural reinforcer condition included the core components of PRT techniques of natural reinforcement, child choice, and interspersing maintenance and acquisition tasks. For example, if the target child spelled the word "train", the child would immediately gain access to play with a toy train.
Results: Â During the motivation condition, the participant scored higher in interest ratings (see Figure 1). During the motivation condition, the participant also scored higher in affect ratings (see Figure 2). The participant correctly identified more letters independently in the motivation condition than the standard worksheet condition for 2-letter, 3-letter, and 4-letter words. The child needed on average twice the amount of prompts to finish an academic task during the standard worksheet condition compared to the motivation condition.
Conclusions: Â When motivational components were embedded into academic tasks, the participant showed higher interest, happiness, and identified more letters correctly. Furthermore, these findings support children with ASD have the ability to complete academic tasks, but rather a lack of motivation can contribute to unfinished work and disruptive behaviors during school.

239 **181.239** Increasing Physical Activity for Adults with Autism Spectrum Disorder through Praise and Technology

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Background: There are many benefits to engaging in physical activity. However, individuals with autism spectrum disorder (ASD) often do not engage in recommended levels of physical activity. Low motivation, poor motor skills, and behavioral challenges combine to make engaging in regular physical activity challenging. Due to higher level of sedentary behavior, individuals with ASD were identified as a special risk group for health challenges such as obesity and secondary conditions (e.g., depression, diabetes; Hildebrandt, Chorus, and Stubbe, 2010; Rimmer, Yamaki, Lowry, Wang, & Vogel, 2010). In this study, reinforcement and technology were used to engage individuals with ASD in physical activity.
Objectives: (1) To compare the effectiveness of direct praise statements (i.e., praise delivered in-person) and technology-based praise statements (i.e., praise delivered through an iPod) aimed at increasing engagement in physical activity. (2) To determine if levels of engagement in aerobic activity could be maintained when praise statements were systematically faded. (3) To determine if engagement in aerobic activity could be generalized to a new setting. (4) To explore student and teacher perspectives of physical activity, including aerobic activity, as well as the interventions used in the study.
Methods**:** Three young adults with ASD and intellectual disability participated in this alternating treatment, single-case design study. Three dependent variables were measured including the distance of each session, the duration of each session, and the number of steps participants took in each session. The independent variable was praise statements provided to participants in two conditions: direct praise statements and technology-based praise statements. Study phases included baseline, comparison, best treatment, fading, and generalization phases. Probes were also conducted after baseline to evaluate whether or not the evaluated components had a differential effect on aerobic activity as well as after the best treatment phase that served as an additional component of experimental control. Social validity interviews were conducted before and after intervention for both participants and teachers.
Results**:** Praise statements were effective in increasing engagement in physical activity in both conditions compared to baseline averages. Two participants performed better and preferred the technology-based condition. The two participants who performed better in the technology-based condition were also able to maintain performance levels during the fading conditions and generalize their performance to a new setting while the participant who performed better in the direct condition was unable to maintain performance levels during fading conditions or generalize performance to a new setting. The strategies used in this study were also well-received by teachers and participants. Inter-observer checks were assessed on over 33% of sessions for each phase with mean agreement of 96.9%. Moreover, procedural fidelity was 99.0% (more than 33% of sessions were assessed). Refer to Figure 1 for results across study phases for distance.
Conclusions: The findings indicate that receiving praise through technology may be effective in increasing levels of physical activity for individuals with ASD and ID. With technology commonly used in schools, it is important to determine its advantages or disadvantages to provide needed support over more traditional (non-technology) forms of support.

240 **181.240** Initial Outcomes of a RCT of a Comprehensive School-Based Intervention for Children with HFASD

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Background:
There are few evidence-based interventions for the social, social-communication, and behavioral deficits of children with ASD who have relative strengths in cognitive and language domains, i.e., high-functioning ASD (HFASD). School-based interventions for children with HFASD present an opportunity to address these deficits. Previous studies have supported the feasibility and initial efficacy of the current intervention protocol (Lopata et al., 2010; 2012).
Objectives:
This study reports the initial results (years one and two) of an ongoing four-year randomized controlled trial (RCT) of a comprehensive school-based intervention (schoolMAX) for children with HFASD.
Methods:
Participants: The sample included 54 children, aged 6-12 with HFASD (28 children in the treatment condition and 26 children in a "business-as-usual" control condition). Random assignment was at the school level with 8 schools each in the treatment and control condition. Participants had a prior clinical diagnosis of ASD, a WISC-IV short-form full-scale IQ >70 (at least one composite, VCI or PRI >80), and a CASL expressive or receptive language score >75. All diagnoses were confirmed using the ADI-R.
Measures: Adapted Skillstreaming Checklist (ASC, completed by Parent and Teacher), Social Responsiveness Scale - Second edition (SRS-2, completed by Parent and Teacher), Cambridge - Mindreading Face-Voice Battery for Children (CAM-C, Faces and Voices), and the Social Interaction Observation Scale (SIOS).
Procedures: The 10-month schoolMAX intervention included social skills groups, therapeutic activities, computerized instruction in emotion recognition, an individualized behavioral plan, and parent training. The intervention was conducted by school staff with elements integrated into the school day. A manualized training and consultation model was used to monitor and ensure ongoing intervention fidelity in treatment condition schools (Thomeer et al., 2015). Control condition schools were monitored for the presence of elements of treatment fidelity using the same manualized forms. Ratings scales, CAM-C testing, and SIOS observations were completed pre- and post-treatment.
Results:
In treatment schools, intervention fidelity averaged 91% or higher for each intervention element. In control schools, elements of intervention fidelity averaged less than 8% across elements. Hierarchical models (adjusting for full-scale IQ and school socioeconomic status) were used to evaluate the impact of treatment condition on change scores. In this initial evaluation of RCT outcomes, four of the seven measures indicated significant treatment effects ($p < .05$). Specifically, parent-rated ASC indicated increased use of targeted social skills, teacher-rated SRS-2 indicated reduced ASD symptoms, and CAM-C Faces and Voices testing both showed increased emotion recognition skills for the treatment relative to control participants.
Conclusions:
Initial results suggest efficacy for the schoolMAX intervention. Four of the seven outcome measures yielded statistically significant positive results. The training and consultation model utilized appears to have been successful at maintaining intervention fidelity. Finally, as these results present the first two of the four years of the overall study, the current analysis may be underpowered to detect effects in some of the other outcome measures.

241 **181.241** Interventions to Improve Oral Care for Individuals with ASD: A Systematic Review

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Background: Oral health is important to both physical and psychological health. Certain populations, such as individuals with autism spectrum disorders (ASD), experience greater oral care challenges as compared to their typically developing peers, suggesting that innovative and efficacious interventions to facilitate care are needed. However, little research currently exists examining oral interventions for individuals with ASD.
Objectives: The purpose of this study was to systematically review interventions designed to improve oral health in individuals with ASD.
Methods: Systematic review methodology as outlined in the Cochrane Handbook for Systematic Reviews of Interventions was used for this paper. Six electronic databases were searched, including: PubMed, CINAHL, Web of Science, Clinical Trials, COCHRANE, and PsycINFO using the keywords "oral/dental health/care," "intervention," and "autism." Inclusion criteria for article selection included: (1) implementation and investigation of a home and/or dental office intervention to impact oral care health and/or experiences, (2) participants diagnosed with ASD, (3) published in a peer-reviewed journal, and (4) published in English, Spanish, Korean, and/or Portuguese. No restrictions were placed on year of publication or level of evidence, but pharmacological interventions were excluded. Two reviewers independently screened all articles for inclusion. Of the articles included, three reviewers independently extracted data. Methodological quality of studies was assessed by two reviewers using Reichow, Volkmar, & Cicchetti's Evaluative Method for Determining Evidence Based Practice (EBP) in Autism; disagreements were resolved by a third reviewer.
Results: The search produced 325 articles, with only six studies meeting all inclusion criteria. Using the EBP guidelines, one study was scored as a strong indicator of evidence, one as an adequate indicator, and the remaining four as weak. Three interventions examined in-home caregiver education programs to improve oral care in the home and prepare individuals with ASD for future dental visits (weak quality); the remaining three evaluated strategies to reduce behavioral and sensory difficulties exhibited in the dental office (one adequate, one weak, and one strong). Only one study of the total six included adults with ASD, with the others focused solely on pediatric ASD populations. The intervention scored as 'adequate' examined the use of electronic screen media, such as video peer modeling, and watching movies with video goggles, to reduce fear and uncooperative behavior during dental visits. The only intervention study rated as 'strong' was designed and implemented by an interdisciplinary team led by occupational therapists. This study focused on modifying the sensory environment in order to decrease the behavioral and physiological distress of children with ASD at the dentist.
Conclusions: These findings suggest that preliminary evidence exists supporting the use of behavioral and sensory interventions to improve the experience of individuals with ASD at the dentist. However, there is a need for further large-scale studies investigating the efficacy and effectiveness of these interventions in individuals with ASD across the lifespan, including adolescents and adults with ASD.

242 **181.242** Long Term Outcomes of a Social Skills Intervention for Adolescents with ASD

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Background: Friendships are an important source of social support: they provide assistance, facilitate learning, and provide a sense of belonging (Overton & Rausch, 2002). Unfortunately, research by Orsmond, Wyngaarden Krauss, and Mallick Seltzer (2004) suggests that only 8% of adolescents with autism spectrum disorder (ASD) have friendships. The Program for the Education and Enrichment of Relational Skills (PEERS), a social skills intervention for adolescents, has a strong evidence base for use with individuals with ASD (e.g., Mandelberg et al., 2014). Autism Ontario has been running PEERS for adolescents at sites across Ontario for the past three years.
Objectives: Although a number of studies have demonstrated the effectiveness of the PEERS program few have examined long term outcomes. Further, no research was found that explicitly examined parent perceptions of the program after teens had opportunities to practice the skills they learned in the program over a protracted period of time. Similarly, few, if any, studies, have examined barriers to long term application of tools learned in the program. The goal of the present study was to address these knowledge gaps.
Methods: An online questionnaire was circulated to parents and teens who had completed the PEERS program 6 months to 3 years prior. The questionnaire contained standardized measures (e.g., Spence Social Anxiety Scale), and items inquiring about parent perceptions of gains teens made in the program and barriers to implementing skills from the program.
Results: To date seventeen families completed the follow-up questionnaire. Data collection is ongoing (target: 30 participants). Adolescents ranged in age from 12 to 19 years of age (M = 15.50, SD = 2.00) and were 58.82% male. 60% of parents reported that their teen continued to have get-togethers since the completion of the PEERS group sessions. All parents endorsed skills in which they felt their teen had improved since the program ended, even though they did not initially feel their teen had acquired these skills while still in the program. The skill most commonly endorsed was "being a good sport"; endorsed by 46.15% of parents. "Sharing the conversation" and "choosing appropriate friends" were endorsed by 38.46% of parents. 80% of parents reported that the quality of their teen's friendships had improved and 100% of parents reported that the parent training portion of the program had been helpful for themselves and their teens. Despite these overwhelmingly positive results, some challenges were reported. 86.67% of participants reported experiencing barriers to implementing skills learned in the PEERS program. Open-ended responses from parents indicated a range of barriers including difficulty finding and identifying potential friends for their teens and lack of time. Parents were also asked to indicate barriers specific to enrolling their teen in new social activities. Barriers included difficulty finding groups that were of interest to the teen (55.56%) and not enough time (33.33%).
Conclusions: Results are promising and provide evidence for continued improvement in social skills well beyond the end of the PEEERS program. These included skills that had not been seen by parents immediately after the program.

243 **181.243** Mental Health in Adults with ASD: Impact of the Success Program

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Background:
The burgeoning population of adults with ASD is considered an emerging public health challenge (Bailey, 2012). Clinical reports suggest that mental health disorders are prevalent in adults with autism (Guillot, 2007). Research studies with adults with ASD indicate a rise in emotional disorders such as depression and anxiety in adulthood even when individuals receive autism specific treatments (Mazurek, 2014). The literature to date suggests mental health issues are common among adults with ASD, but what is unknown is how to best address such mental health issues (Trembath, 2012).
Objectives:
This study assessed mental health outcomes in adults with ASD as a result of an innovative intervention, SUpported employment, Comprehensive Cognitive Enhancement and Social Skills (SUCCESS) program. The SUCCESS intervention targets increasing executive functioning and social cognitive skills in adults with ASD. As part of the SUCCESS program, co-occurring mental health issues were measured using the Adult Self-Reports (ASR) and Adult Behavioral Check List (ABCL) to understand the impact the intervention may have on mental health issues, such as anxiety disorders, attention deficit hyperactivity disorder (ADHD), depression and related internalizing and externalizing symptoms.
Methods:
A total of 8 young adults participated in an open trial pilot study of the SUCCESS program (with an additional sample of 12 participants currently receiving the intervention and the data will be available for analyses by April 2017). ASR and ABCL were obtained pre and post the SUCCESS intervention. SUCCESS was delivered weekly for 90minutes via active group participation during a simulated work meeting within a larger vocational training program in a community vocational service. The program involved 24 sessions over 5 months with the first half of the curriculum teaching executive functioning skills as attention, learning, memory, prospective memory, cognitive flexibility, problem solving, goal oriented thinking and contextual awareness. The second half teaching social communication skills including social conversation (giving and receiving compliments, feedback and help), social relationships, initiations and social networking (including do's & don'ts of social media). Participants completed the ASR and parents completed the ABCL.Â The majority of participants were male (77%), white race/ethnicity (88%) with a mean age of 22 years (SD=3.67) and all graduated with a high school diploma. Some were involved with various social services: 33% disability services, 22% department of rehabilitation, 0% social security income.
Results:
Analyses consisted of calculating effect sizes using Cohen's d to measure the magnitude of the effect of the SUCCESS intervention on mental health symptomatology. Preliminary findings reveal positive outcomes per self-reports (ASR). Participants are reporting less anxiety and avoidant issues and less overall internalizing, externalizing and total symptoms. No improvements were reported by parents (ABCL) (Refer to Tables). These differences by informant reflects the differences of an external perception of mental health from parents to the self-perception from individuals.
Conclusions:
This pilot study demonstrates that mental health issues may improve by targeting other core autism related symptoms as executive functioning and social cognition skills. More study is needed before conclusions can be drawn.

244 **181.244** Multi-Informant Assessment of Transition-Related Skills and Skill Importance in Adolescents with Autism Spectrum Disorder

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Background: Post-high school outcomes are bleak for students with autism spectrum disorder (ASD). One malleable contributor to post-school outcomes is the quality of the transition plans developed as part of the Individualized Education Plan. The Secondary School Success Checklist (SSSC) is a new measure developed to allow students across the spectrum to describe their current skill level in transition-related domains as well as rank their priorities for goal setting, thus actively contributing to the transition planning process. The SSSC is designed to collect data from the perspective of multiple informants including the student, their parents, and the student's teacher.
Objectives: This study examines (a) the transition-related skill level of adolescents with ASD as reported by each respondent group, (b) the perceived importance of each skill across respondent group, and (c) the relationships between the rankings of each respondent group.
Methods: Data were drawn from a larger ongoing RCT of high school students with ASD. The sample includes 547 adolescents (mean age= 16.4; mean nonverbal IQ=85.8; mean Vineland=75.8) and their parents from 3 states. The student version of the SSSC has 20 items, each which is linked to key items on the teacher and parent versions (105 items). Both sets of items were representative of four key domains: independent behavior, transition, social, and academic. For each item, participants indicated on a Likert-type scale if the behavior was: 0="not like me", 1="like me", or 2 = "much like me". Respondents also provided a priority ranking for learning each item. Mean levels of skill performance and importance were reported across domain and informant, and differences between groups and domains were examined. The inter-rater reliability across respondents for skill level and priority scores were conducted, and we ran paired sample t-tests to determine which domains were rated as most important by informant group.
Results: Adolescents rated themselves as higher skilled on SSSC items than did parents or teachers. Teachers rated most skills higher than parents. There were significant differences across the informant groups, with differences on up to 18 of 20 items (adolescent- parent) and very low agreement across raters (weighted Cohen's kappa= adolescents with parents, .10 and teachers .11; parents and teachers=.20). Although the ratings varied, there was some agreement in the ranking of the highest and lowest rated skills across all three groups. Adolescents consistently had lower percentages on items marked as a priority across skills and informant group. Parents were most likely to rate skills as a priority for learning.
Conclusions: This is the first study to examine the perceived skill level and importance of transition-related skills among adolescents with ASD, their parents, and teachers. This is the largest current sample of adolescents with ASD and this data provides an important snapshot into student performance of key transition-related skills, providing a profile of both student strengths and needs as reported by multiple informants. The findings provide guidance for staff and families during the transition planning process, as well as inform researchers on intervention development/ implementation to ensure priorities are addressed.

245 **181.245** Music Improves Social Communication in Autism Spectrum Disorder – a Randomized Control Trial

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Background: Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder characterized by pronounced difficulties in social and communication abilities. However, many individuals with ASD demonstrate enhanced perceptual skills, especially in the auditory domain (Heaton, 2009). Based on these and other complementary findings, music therapy has been suggested as a promising approach to improve social communication in ASD (Simpson and Keen, 2011). However, there is currently limited empirical evidence supporting its clinical use (Geretsegger et al, 2014).
Objectives: The present study aims to evaluate the effects of a music-based intervention on language and social communication in children with ASD, compared to a non-music control intervention using a randomized control trial design.
Methods: Fifty children aged 6-12 years with a diagnosis of ASD participated in a single-blind, parallel-arm randomized control trial of music therapy that is currently ongoing (ISRCTN26821793). Here, we report data from 18 children who have completed the trial. Participants were randomly assigned to 12 weekly sessions of individual music (MT, n=9) or non-music (NM, n=9) control therapy. Music therapy sessions involved use of songs and rhythmic cues to improve turn-taking and reciprocal social interactions as well as communication. The non-music control therapy targeted similar skills but without the use of music. Both groups were matched on age, sex, IQ and socioeconomic status. Participants underwent extensive behavioral assessment before (T1) and after therapy (T2). Primary outcome measures at both time points included receptive vocabulary using the Peabody Picture Vocabulary Test (PPVT), social skills using the Social Responsiveness Scale (SRS-2), and communication using the Children's Communication Checklist (CCC-2). Data were analysed using repeated measures ANOVA.
Results: Compared to NM, a larger proportion of children in the MT group showed an improvement over 12 weeks in social communication. Specifically, 75% of MT had improved CCC-2 scores at T2 compared to 44% of NM (Figure 1). Overall PPVT and SRS-2 scores showed no significant differences between the groups over time ($p>.05$). However, there was a trend for an interaction between group and time point for CCC-2 in the direction of improvement for MT ($p=.087$). Trends of improvement in MT at T2 compared to NM were observed on the CCC-2 subscales Interests ($p=.061$), Initiation ($p=.077$), and Nonverbal Communication ($p=.094$). Additionally, both groups showed significant improvement on the CCC-2 subscale Social Relations ($p=.023$). A trend towards improvement on the SRS-2 subscales Social Cognition ($p=.062$) and Social Communication ($p=.089$) was also observed for both groups (Figure 2).
Conclusions: These findings suggest that music therapy may lead to specific improvements in social communication in ASD, in particular in terms of interests, initiation, and nonverbal communication compared to non-music interventions. Additionally, music therapy demonstrated equivalent improvement in social relations, social cognition and social communication compared to the non-music therapy. Results from this preliminary analysis provide support for the use of music as a therapeutic tool for children with ASD. This work will provide insight into both behavioural and neural mechanisms mediating response to music-based interventions in children with ASD.

246 **181.246** Parent and Child Factors Related to Homework Completion in Cognitive-Behaviour Therapy for Children with ASD

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Background: Homework is recognized as a crucial component of participation in cognitive behavioural therapy (CBT) for children as it provides opportunities to practice techniques outside of the therapy environment, aiding in skill-mastery (Kazantzis, Deane, Ronan & L'Abate, 2005). Empirical evidence suggests that treatment outcomes are enhanced with CBT that includes homework, in comparison to programs that only involve in-session work (Mausbach, Moore, Roesch, Cardenas & Patterson, 2010). There are a number of parent and child factors related to poor participation (i.e. uncompleted homework), such as parent stress and psychopathology, and child functioning (Kazdin & Wassell, 1999), however research has yet to explore this relation in participants with ASD. With the increasing use of CBT to treat anxiety and behavioural concerns in children with ASD (Danial & Wood, 2013), it is important to understand barriers to participation that could have implications on treatment outcomes.
Objectives: To identify parent and child characteristics that relate to homework completion in CBT for children with ASD
Methods: Data were collected from 56 children with ASD (89.3% male) and their parents (82.1% female) as part of a larger, randomized controlled CBT trial. Children were 8 to 12 years of age ($M = 9.66$, $SD = 1.23$) with average IQ ($M = 102.15$, $SD = 14.78$, Range: 79-140). Parents were 35 to 54 years of age ($M = 43.61$, $SD = 4.33$). Prior to treatment, parents completed measures of child psychopathology, emotion regulation, and autism-symptom severity, as well as a self-report measure of depression, anxiety and stress. Children completed a self-report measure of emotion regulation. Homework completion was reported by session therapists as either incomplete, partially completed, or fully completed. A mean completion score was calculated for nine sessions.
Results: Challenges with emotional regulation were significantly related to less homework completion on both parent-report (r (49) = -.42, p = .003) and child self-report (r (48) = -.47, p = .001) measures. Child internalizing problems were also significantly related to less homework completion (r (48) = -.33, p = .02). Externalizing problems, ASD symptoms severity, and parent self-reported depression, anxiety or stress were not related to homework completion. The overall model of child characteristics accounted for 30% of variance in homework completion, $F(3, 39) = 6.86$, p = .001.
Conclusions: Pre-treatment difficulties with emotion regulation and internalizing problems in children with ASD may have implications for their capacity to complete homework in CBT. To support children in completing homework, clinicians should work with families to modify between-session tasks as needed, in order to promote constructive treatment participation.

247 **181.247** Peer-Play Assessments for RCTs: Feasibility of Measuring Generalization from Clinic-Based Socialization Interventions

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Background: Previous research has found social skill group interventions to be an effective evidence-based practice for addressing common social deficits in children with ASD (Reichow & Volkmar, 2010). However, generalization is a concern, and the few studies using informant reports have found minimal evidence for generalization across settings and or people (Bellini et al., 2007). Skill maintenance across time has not been supported in studies evaluating retention using caregiver reports (White et al., 2010; Barry et al., 2003). In contrast, research using school-based social skill observational measures have found reliable, feasible strategies for measuring target social skills (Kasari et al., 2012). To our knowledge, these observation strategies have yet to be used to measure target behaviors in clinical settings.
Objectives: The purpose of this study was to evaluate the feasibility of a clinic-based assessment to measure generalization from a randomized controlled trial (RCT) of social cognitive skills training groups (Seaver-NETT, Nonverbal Emotion recognition and Theory of mind Training) and facilitated play groups (Soorya et al., 2014).
Methods: A sample of 38 verbal children with ASD ages 8-11 years old (31 male, 5 female) were enrolled during the last 3 cohorts of the larger RCT. 34 participants were included in baseline analyses and 12 in pre-post evaluations. Analogue peer play sessions conducted at baseline and endpoint included 1-2 participants with ASD and 2-3 unfamiliar typically developing peers. Sessions were approximately 30 minutes long, consisted of limited interaction with adult facilitators, and included a cooperative task (e.g. art collage) and a group game (e.g. Uno). Using ObserverXT 11, blinded raters coded the sessions for frequency of the following behaviors: instrumental bids, relational bids, nonverbal gestures and continuous interactions. Adequate to high interrater reliability was achieved (mean index of accordance = 81.4%, median = 92.21%). Data analyses evaluated the number of discrete behaviors (e.g. instrumental, relational, nonverbal) and the number of continuous interactions within each session.
Results: Baseline data indicated differential numbers of target social behaviors in children with ASD. Chi-square analyses revealed a significant difference between the number of relational and instrumental behaviors within the sample, with significantly fewer instrumental bids observed relative to relational bids ($X2= 23.72$, $p < 0.008$). Analyses of target behaviors at baseline and endpoint indicated an increase in the number of continuous interactions (($X2= 9.00$, $p < 0.003$). Correlational analyses revealed a positive relationship between the number of post-treatment continuous and instrumental behaviors ($r = .82$, $p < .001$). Baseline social cognition scores were also positively associated with the number of post-treatment instrumental behaviors ($r = .57$, $p < .020$).
Conclusions: Data suggest prolonged interactions with unfamiliar peers improved following outpatient social skills groups. These findings support the utility of observational assessment paradigms to measure generalization within clinic-based social skills RCTs. The positive relationship between baseline social cognition scores, endpoint instrumental behaviors, and continuous interactions warrants further study of the role of social cognition in predicting social skills generalization.

248 **181.248** Physiological Wellness Effects of Animal-Assisted Activities in Children with Autism Spectrum Disorder in a Specialized Psychiatric Hospital Program

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Background: Children with ASD are at higher risk for developing co-existing mental health conditions (Szatmari & McConnell, 2011) and consequently experiencing psychiatric hospitalization, compared to the general pediatric population (Kalb et al., 2012). However, hospital environments can be exceptionally stressful for this population (Siegel & Gabriels, 2014), given their social-communication deficits, ineffective emotional regulation skills and heightened physiological arousal (Mazefsky & White, 2014; Bellini, 2006). While the use of animal-assisted activities (AAA) show potential for various improvements in children with ASD in community settings (Gabriels et al., 2015; O'Haire et al., 2013; O'Haire, In Press), these "stress-reducing" and "social-buffering" (Serpell, 2000) benefits have not yet been studied within a psychiatric hospital setting for youth with ASD.
Objectives: Evaluate whether an AAA with canines can lead to reduced physiological arousal and improvements in social-communication as well as aberrant behaviors in children and adolescents diagnosed with ASD in a specialized psychiatric hospital setting.
Methods: Participants were recruited from the Neuropsychiatric Special Care (NSC) program's inpatient and/or partial day-treatment program. Prior to study participation, baseline demographic measures were acquired from caregivers and participants' ASD diagnosis was confirmed. Participants experienced two, randomly assigned 35-minute sessions (AAA and Control Condition) with a minimum two-day washout period between groups. Each session included a baseline 20-minute social skills group immediately followed by a 10 minute experimental or control condition. The AAA condition introduced a canine and volunteer handler for free interaction time while the control condition introduced a novel toy and a volunteer for free interaction. Participants' physiological arousal was continuously assessed throughout all conditions via the Empatica E-4 wristbands (Empatica Inc. 2014). All sessions were videotaped for behavioral coding using the Observation of Human Animal Interaction for Research – Modified, v.1 (OHAIRE-M1; O'Haire, Gabriels, Germone (unpublished manual).
Results: Baseline demographics: age (*M*=11.1 years, *SD*=3.7), 82.4% male, Aberrant Behavior Checklist (ABC)-Irritability subscale (*N*=28; *M*=26.3, *SD*=9.1), Aberrant Behavior Checklist (ABC)-Hyperactivity (*N*=28; *M*=32.7, *SD*=21.8), Leiter-3 NVIQ (*N*=23; *M*=92.1, *SD*=24.1), ADOS-2 comparison score (*N*=22; *M*=7.1, *SD*=2.7) and 86.4% (*N*=22) have a co-existing psychiatric diagnosis. Due to the timeline of this study, planned analyses will begin in January 2017. Between two conditions analyses will include 1) changes in electrodermal activity and 2) changes in behavioral coding data.
Conclusions: This study is expected to demonstrate that children with ASD show reduced physiological arousal in the presence of canines, compared to a control condition in the context of a specialized psychiatric care hospital unit. Additionally, behavioral data is expected to display improved social communication and reduced aberrant behaviors when in the presence of a canine. While canines are commonly enlisted in hospital settings to promote a positive patient experience, there has been minimal empirical research evaluating potential outcomes of this type of activity in general. This study is the first to provide data regarding the wellness and physiological effects of the human-animal bond for children with ASD in hospital settings.

249 **181.249** Piece It Together: Exercise and Wellness Program for Transitional Age Youth with Autism Spectrum Disorders and Mild Developmental Disorders

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Background: Youth with Autism Spectrum Disorder (ASD) and other neurodevelopmental disorders are at increased risk of poor health and obesity due to limited interests, sedentary lifestyles, sensory challenges, restricted diets, and medications used to treat their disorder. The “Piece It Together” Program was developed by multidisciplinary professionals with expertise in fitness, nutrition and mental health to provide a comprehensive wellness program for teens and young adults with ASD and other mild neurodevelopmental disabilities. Five primary components of the program include nutrition, exercise, socialization, stress reduction, and opportunities to get out of your comfort zone. The curriculum includes strength and cardiovascular conditioning, nutrition education, mindfulness, yoga and stress reduction strategies to promote healthy lifestyle choices.
Objectives: To provide an organized environment for transitional age youth with ASD and other mild neurodevelopmental disorders to increase exercise, improve nutrition, socialize with peers with and without disabilities, practice stress reduction strategies, and encourage opportunities to get outside of your comfort zone.
Methods: Participants attended 90 minute sessions at the Medical University of South Carolina Wellness Center twice-a-week, for six-weeks. As each individual had unique strengths and weaknesses, each established nutrition, fitness, socialization, and stress reduction goals. FitBit devices were distributed to participants. Assessments were done at the first and last classes, including InBody 570 Analyzer©2014 assessments, PHQ-9, 5-2-1-0 Healthy Habits Questionnaire, Flourish and Fitness Scale, PHQ-9 questionnaire, and lifestyle questionnaires. Volunteers provided support in class and have included health profession trainees.
Results: The 2015 Summer Program included 12 individuals (7 males) ages 15 to 27. Average PHQ-9 depression scores decreased from 7.67 to 3.42 (from mild to minimal depression; $p<0.000063$). Self-reported 5-2-1-0 Heathy Habits data revealed more fruits and veggies in the diet at time 2 ($p =0.04$) and modest improvement in self-efficacy related questions (e.g., I like the way I look/I am a good worker; $p=0.03$). In 2016, the Summer program included 21 participants (16 males), ages 13-28 that attended regularly and for some it was their fourth summer participating. Challenges were noted with youth with high irritability and cognitive deficits. However, pre and post testing revealed decreases in depression scores, increases in skeletal muscle, decreases in visceral body fat, improvements in nutrition and increases in socialization. The increased support to use Fitbits appeared to increase movement as well as social engagement through Fitbit friends.
Conclusions: This 6-week Summer program successfully brought together a unique group to build friendships and make healthier lifestyle choices and has continued as a weekly program. Individual successes are numerous as each individual has a success story of individualized goals that have been met, and the greatest success has been measured by continued participation focused on 5 main components that are commonly needed for youth with ASD. The use of Fitbits provided a platform for goal setting and increased physical activity outside of class. Almost all participants continue to participate in a weekly class and communicate with each other outside of class. Future efforts are to encourage maintenance of lifestyle changes and minimize barriers to participation.

250 **181.250** Prefrontal Neurofeedback Training in Children with Autism

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Background: Electroencephalographic (EEG) biofeedback training (i.e., neurofeedback) is a treatment potentially useful for improvement of self-regulation skills in autism spectrum disorder (ASD). There are several techniques proposed to target symptoms of ASD using neurofeedback, with most differences being in the type of training (e.g., power of EEG bands, theta/beta ratio, coherence), topography (Cz or Pz), guidance by quantitative EEG (qEEG) and number of neurofeedback sessions (e.g., 20 vs. 30, etc.).
Objectives: We proposed that prefrontal neurofeedback training will be accompanied by changes in relative power of EEG bands (e.g., 40 Hz centered gamma band) and ratios of individuals bands (e.g., theta/beta ratio) and will be more effective with higher number of training sessions (e.g., 12 vs 18 sessions). Outcomes measures along with EEG included as well behavioral ratings by parents/caregivers
Methods: In the first pilot study on 8 children and adolescents with ASD (~17.4 yrs) we used 12 session long course of neurofeedback from AFz site, while in the second study on 18 children (~13.2 yrs) we administered 18 sessions of 25 min long prefrontal neurofeedback training. The protocol used a training procedure, which according to specifications, represents wide band EEG amplitude suppression with simultaneous upregulation of 40 Hz centered gamma activity. Custom-made Matlab program developed for the analysis of EEG data using wavelet analysis was useful to detect changes in EEG profiles during neurofeedback sessions. Quantitative EEG analysis at the training site was completed for each session of neurofeedback using a custom-made MATLAB application to determine the relative power of the individual bands (delta, theta, alpha, low beta, high beta, and gamma) and their ratios (theta/low beta, theta/high beta, etc.) within and between sessions. In both studies we analyzed Aberrant Behavior Checklist (ABC) ratings by caregivers (pre- and post-treatment).
Results: The pilot study that used only 12 sessions showed significant qEEG changes sessions but did show only trend of progress across the 12 sessions even though changes of individual EEG bands and their ratios were significant. The 18 session course of neurofeedback showed more significant improvements both in behavioral and qEEG measures. There was found a significant reduction in Lethargy subscale of the ABC. The rating scores showed reduction (from 10.18 ± 6.07 to 7.53 ± 5.82, $t(17)=3.29$, $p=0.005$), while Hyperactivity scores also showed decrease (from 16.65 ± 13.78 to 13.29 ± 11.97, $t(17)=2.56$, $p=0.021$).
Conclusions: Our experiments showed advantages of 18 session long weekly prefrontal neurofeedback course in children with autism. More future research is needed to assess qEEG changes at other topographies using brain mapping and using other outcome measures including behavioral evaluations to judge about clinical utility of prefrontal neurofeedback in children with ASD.

251 **181.251** Prevention of Elopement-Related Injuries in Children with ASD

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Background: Â Elopement behavior (EB), sometimes termed “wandering”, is emerging as a significant contributor to morbidity and mortality among individuals with Autism Spectrum Disorder (ASD). Causes of death among individuals with ASD who elope include drowning and traffic accidents. Prior investigations have established a high rate of elopement among children with ASD, ranging from 26%49%. To prevent elopement-related injury and death, parents implement a wide variety of environmental, behavioral, electronic, and pharmacologic interventions. What is not known, however, are the relative costs, effectiveness, burdens and side effects of these interventions among children with ASD.
Objectives: Â To assess caregiver responses to EB among children and adolescents with ASD and cooccurring disorders such as ID, ADHD, and Language Disorder, as well as their perceived costs, effectiveness, and burden of use.
Methods: Â Parent participants in the Interactive Autism Network (IAN) — a large, validated and verified, internet-mediated, parent-report autism research registry — were invited to complete a survey about their children with ASD ages 4 or older. Inclusion criteria were survey completion, professional diagnosis of ASD, confirmatory Social Communication Questionnaire score of >=12, Social Responsiveness Scale score, and completed birth and diagnosis questionnaire. Survey items included past and current patterns of EB, consequences of the behavior, parental responses and interventions attempted to prevent the behavior (including medications) or harmful outcomes, their perceived effectiveness, burden of use, and estimated costs.
Results: Â Caregivers mobilize community resources including neighbors, school personnel, and police during elopement incidents. Caregivers were nearly twice as likely to receive advice on managing elopement from an ASD advocacy organization (22%) as a physician (12%), and 44% received no advice or guidance from any source. Caregiver strategies to prevent EB and negative consequences included a variety of physical, electronic, and behavioral interventions. Many environmental interventions such as locks, door alarms, security systems, and fencing were rated as highly effective. Security systems were rated as highly effective but more expensive, while GPS trackers were rated as less effective and more burdensome. Aide services were rated as highly effective but generally provided through insurance, school, or local agencies rather than being paid for out of pocket. A variety of medications administered specifically to reduce EB or for other disorders were generally rated as ineffective in reducing EB and parents reported significant rates of side effects.
Conclusions: Caregivers use a variety of intervention strategies to prevent EB and related injuries and death in youth with ASD. Environmental and behavioral interventions are generally rated as much more effective than medications in reducing EB. Clinicians should screen for elopement behavior in children with ASD and advise the use of inexpensive, easy to implement interventions such as locks, door alarms and dead bolts for children who elope. GPS tracking devices may be effective in some patients but more expensive and burdensome. Caution is indicated when prescribing medications off-label to reduce EB given parental reports of their poor effectiveness and side effect burden. Further study of interventions to prevent EB including their associated costs, effectiveness, and burden of use is indicated.

252 **181.252** Profile of Skills and Symptoms in Transition Aged Youth with ASD

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Background: Outcome data for adults with Autism Spectrum Disorder (ASD) are poor, showing under-employment, reduced social engagement, high frequencies of co-morbid mental health issues and lower reported quality of life. Despite progress in assessment and treatment of skills deficits for young children with ASD, few have focused on defining the needs of transition-age youth, specifically to produce more successful outcomes into adulthood. Identifying and addressing the skill gaps relevant to adult life during the high school years, provides the opportunity to better utilize services available to adolescents and better prepare teens for the transition to adulthood.
Objectives: This study provides descriptive profile data of adolescents with Autism Spectrum Disorder, in order to better identify needs specific to transition to adulthood.
Methods: As part of a larger, on-going project, adolescents aged 14-19 with ASD were recruited. Adolescents in the study did not have comorbid ID or active psychosis and were able to self-report. Baseline assessment data were collected. Adolescents completed the ARC Self-Determination Scale (SDS), The Intolerance to Uncertainty Scale (IUS), and a PROMIS profile scale (profile 49 or 43 dependent on age). A parent of the adolescent completed the Waisman Activities of Daily Living (WADL) Scale, the caregiver version of the IUS, and PROMIS proxy scales for Anxiety, Depression, Anger and Peer Relations (for individuals under 18). Currently 17 adolescents have completed the baseline assessments; however it is anticipated to enroll 60 individuals in the project by May, 2017.
Results: Compared to means from a normed sample of adolescents, the individuals with ASD in this study reported lower mean scores on the SDS, particularly on the autonomy subscale (ASD M = 48.38, SD = 17.7, normed population M = 63.35, SD = 15.5, $t = -3.42$, $p < .01$). The autonomy subscale of the SDS was not correlated with the WADL; though the WADL scores showed age-related increases, similar to larger longitudinal studies. Parents rated their child’s IUS (M = 68.35, SD = 22.57) on average 27.7 points higher compared to the participant’s self-report (M = 50.53, SD = 18.9). Adolescent IUS scores correlated with adolescent self-report (PROMIS 49/43) of anxiety ($r = .70$, $p < .01$), and parent proxy IUS scores correlated with parent proxy anxiety scores (PROMIS subscale; $r = .63$, $p < .05$), however parent and adolescent IUS scores did not correlate with each other ($r = .28$, ns). Self-realization scores (related to measures of self-esteem) correlated to self-reported depression symptoms (PROMIS 49/43), $r = -.81$, $p < .001$.
Conclusions: Â Adolescents with ASD scored lowered on self-determination measures compared to reported norms, which may provide insight into important skills areas to target among transition aged students with ASD. Also noticeable was differences between the adolescent’s reporting and parent proxy reporting. This may also be important to consider to gain more complete picture of the adolescent’s needs; current data show very limited involvement in IEP and service planning meeting by the adolescent with ASD, but instead parents and guardians speaking on their behalf.

253 **181.253** Public Perceptions of Autism Treatments: Does Source Credibility Matter?

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Background: Scientifically validated instructional strategies have been identified to improve behavioral symptoms associated with autism (see Wong, 2014 for a review), however families and practitioners often give credence to “fad” approaches that lack evidentiary support. Not only are fad treatments, such as sensory integration therapy and special diets, unlikely to be effective, but they may delay or even prevent individuals with autism from accessing evidence-based intervention that is more likely to produce favorable outcomes.
Objectives: To explore factors that can influence the public’s acceptance of autism treatments, specifically evidentiary support and source credibility.
Methods: Adults read a series of texts describing different autism treatments (*N*=379). The text presentation was based on a 2 x 2 within-subjects factorial design with treatment status (evidenced-based vs. fad) and credibility of the source in the text (credible vs. non-credible) as the independent variables. Thus, participants read about evidence-based treatments (EBP) presented by credible sources, EBP presented by non-credible sources, fad treatments presented by credible sources, and fad treatments presented by non-credible sources. Participants rated the degree to which they believed the treatment would be effective (believability); the extent to which they would either use or recommend the treatment to someone else (intentionality), and credibility of each treatment using a Likert scale. In a subsequent *instruction manipulation* condition, the text remained the same but participants were instructed to “pay attention to the credibility of the source providing information.”
Results: Â Our analyses reveal an overall main effect of treatment status, $t(377) = 12.56$, $p < .001$ such that EBP were rated as more credible than fad treatments. We also identified a main effect of source credibility, $t(377) = 8.33$, $p < .001$, such that credible sources were rated as more credible than non-credible sources. Participants considered the credibility of the source only when explicitly instructed (instruction manipulation condition). Participants successfully differentiated between the credibility of EBP texts, $t(129) = 5.61$, $p < .001$, with EBP descriptions presented by credible sources ($M = 3.85$, $SE = .07$) receiving higher credibility ratings than those from a non-credible source ($M = 3.33$, $SE = .08$). Â We also find that fad texts from a credible source ($M = 3.68$, $SE = .04$) received higher credibility ratings than those from a non-credible source ($M = 2.81$, $SE = .08$; $t(129) = 6.27$, $p < .001$. In this condition, participants’ ratings of EBP presented by a non-credible source did not differ from fad treatments presented by a credible source.
Conclusions: These results suggest that people do not naturally attend to source credibility when evaluating treatments described in print.Â Manipulation instructions to attend to the credibility of sources had the intended effect: credibility ratings of non-credible sources were reduced and credible sources increased regardless of EBP status. This also meant that credibility ratings increased even for fad approaches presented by credible sources (e.g., physicians presenting pressure/weighted vests), which may indicate a maladaptive over-correction effect.

254 **181.254** Randomised Controlled Trial of the Use of the BLUE Room Virtual Reality Treatment to Reduce Situation Specific Anxiety in Young People with ASD

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Background:
Young people with ASD are prone to anxiety; around 50% of those with ASD meet criteria for at least one anxiety disorder. Specific fears and phobias are one of the most frequent subtypes.
Graduated exposure and participant modelling are identified as evidence-based treatments for specific fears/phobias, but may require adaptation for individuals with ASD. One adaptation may be the use of a virtual reality environment (VRE) to reproduce the anxiety provoking situation. This removes the need to use imagination, and provides a way to gradually increase exposure to an anxiety provoking stimulus.
Following a successful development study with 9 children (Maskey et al 2014, PLoS One), we investigated further whether the Newcastle Blue Room Treatment may be effective for children attending child mental health services by conducting a randomised trial. The treatment involves sessions in an immersive VRE with a therapist.
Objectives:
To test the effectiveness of virtual reality exposure in overcoming a specific fear/phobia, reporting outcomes at 6 months after treatment.Â
Methods:
32 verbally fluent young people with ASD aged 8-14 years, who have a specific fear/phobia, were recruited from two mental health trusts. Children were randomised to immediate treatment (n=16) or delayed treatment (n=16; receiving treatment after their six month follow-up). Each participant received one preparatory home visit, followed by four 20 minute sessions in the fully immersive VRE with a scene designed specifically around their specific fear/phobia. During each session, they received coaching in relaxation techniques and coping self-statements from a therapist who accompanied them. The Newcastle Blue Room Treatment uses state of the art technology (http://blueroomisv.com/).
Before and after each VRE session, the child and parent (who was observing from another room) rated the child’s anxiety using a six point scale. Anxiety at baseline and six-month end point was measured using the Spence Children’s Anxiety Scale and the FEAR survey. Vignettes describing the anxiety to be addressed during the treatment, and the family impact, were written at baseline. Subsequently, a blinded researcher contacted the families 2 weeks and 6 months post-intervention (or equivalent for the delayed arm) and completed vignettes characterising the child’s anxiety-related behaviour at those timepoints. Change in symptoms across time as depicted in the vignettes was the primary outcome measure. The vignettes were compared by an expert panel (blinded to timepoint and treatment group) to assess degree of improvement/deterioration of symptoms and impact on a 9 point scale. The top three points described a responder.
Results:
At six months follow up the immediate treatment group had improved significantly more than the control group (t= -3.230, p=0.005). Half of the immediate treatment group met criteria for being aÂ ‘responder’; none of the delayed treatment group responded. Results from other outcome measures will be presented at the conference.
Conclusions:
This study has shown that the individually tailored, Newcastle Blue Room Treatment comprising virtual reality exposure in conjunction with CBT is an effective treatment for children with ASD and situation specific anxiety, specific fears and phobias.

255 **181.255** Reduced Levels of Parental Anxiety, Depression and Stress Following Pivotal Response Treatment

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Background:
Parents of children with intellectual and developmental disorders are more susceptible to physical health problems, psychological stress, depressive and anxiety disorders (Miodrag & Hodapp, 2010; Taylor & Warren, 2012). Meta-analysis of past studies done by Singer in 2006, estimated that 30-35% mothers of children with developmental disabilities are likely to have elevated levels of depressive symptoms (Singer, 2006).
Objectives:
We characterized the severity of anxiety, depression and stress in parents of children with Autism Spectrum Disorders (ASD) and the change of these symptoms in those who took part in Pivotal Response Treatment (PRT).
Methods:
We measured anxiety, depression and stress in 116 parents of children with ASD using the Beck Anxiety Inventory (BAI), Beck Depression Inventory, Second Edition (BDI-II) and Parental Stress Index, Forth Edition (PSI-4), respectively.
Then, we investigated the reduction of these symptoms in 25 of the parents (15 mothers and 10 fathers) after they participated in a 16-week trial of PRT. PRT is a naturalistic behavioral treatment that aims to improve a child's social communication skill. PRT is a 16-week trial that includes 7 hours/week of individual work with a school-age child with autism and parent training. To measure the change in social functioning of the children who participated in PRT, parents completed Social Responsiveness Scale, Second Edition (SRS-2) before and after the intervention.
Results: Â
Out of 116 parents of children with ASD, 22% reported mild to moderate levels of depression (total BDI score >14), 3% reported moderate to high levels of anxiety (total BAI score >22) and 22% exhibited high levels of stress (total PSI-4 raw score >110).
Of the families who participated in the PRT trial, parents reported a significant decrease in their anxiety (BAI Total Score: pre-PRT M= 5.44, SD= 6.72; post-PRT M= 4.28, SD= 6.07, $p<0.05$) and stress (PSI-4 Total Score: pre-PRT M= 95.67, SD= 18.24; post-PRT M= 82.71, SD= 18.26, $p<0.001$). Individual PSI-4 subdomains, Parental Distress Score ($p< 0.01$), Child Dysfunctional Interaction Score ($p<0.001$) and Difficult Child Score ($p<0.01$) decreased significantly as well. A trend toward decreasing levels of depression was observed (BDI Total Score: pre-PRT M= 8.36, SD= 7.26; post-PRT M= 6.68, SD= 6.62, $p=0.065$).
The improvement in social functioning of children who participated in PRT, as measured by SRS-2, was correlated with the reduction in parental depression ($r=-0.523$, $p<0.001$) and stress ($r=-0.489$, $p<0.01$).
Conclusions:
Our results show that rates of depressive symptoms and stress are high in parents of children with ASD and their symptoms are reduced after participating in PRT. The parent training component of PRT provides parents with the support and training to effectively implement PRT. Being actively engaged in PRT and witnessing the positive improvements in their children due to the intervention relieves the stress and anxiety parents have about their children and their disorder. It also provides them with a sense of hope for the future of their children.

256 **181.256** Regression in Children with ASD: Clinical Profile and Short Term Outcome.

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Background: The phenomenon of developmental regression in children with Autism Spectrum Disorder (ASD) is well studied. Much is known about the prevalence of regression, age of onset and pattern of regression. Few studies have been conducted on the outcome of intervention on children with ASD and developmental regression. The findings from these studies are inconclusive. Present study compared the impact of parent training intervention on young children with ASD and history of regression (ASD-r) to children with ASD and no history of regression (ASD-nr).
Objectives: To assess the short term outcome of children with ASD with/without regression after receiving a two week in-patient, parent training.
Methods: The participants were children (aged 3- 10 years) diagnosed with Autism Spectrum Disorder according to DSM-V. Children and their parents were admitted in the in-patient child psychiatry facility for 2-3 weeks. Detailed baseline assessments were done using Childhood Autism Rating Scale 2ndedition (CARS- 2), Indian Scale for Assessment of Autism (ISAA), Vineland Social Maturity Scale (VSMS), Family Interview for Stress and Coping -ASD (FISC-ASD), Autism Parenting Stress Index (APSI) and Autism Treatment Evaluation Checklist (ATEC). Detailed history of child's development and regression was obtained from the parents. Regression here was defined as loss of a previously acquired skill anytime during the child's development. Parents received daily individualised sessions aimed at home based training. FISC-ASD was re-administered at the time of discharge. APSI and ATEC were re-administered over telephone after three months of discharge from the hospital.
Â Results: Â Out of twenty children (M=16, F=4) recruited in the study, seven children (all males) had history of developmental regression. The mean age at recognition of regression was 24.57 (months) ± 10.72. Out of seven children with regression, four children had regression on the background of delayed development. Four children had regression of language and social milestones, two had regression in all developmental areas and only one child had regression in language. No precipitating factor was reported by parents around the time of regression. Workup for degenerative disease was nil contributory in all these cases. Rate of perinatal complications and co-morbid disorders were lower in children with ASD-r as compared to children with ASD-nr. Baseline scores of CARS – 2, ISAA, VSMS, FISC-ASD, ATEC and APSI were same for children with ASD-r and ASD-nr. Children with ASD-r had statistically significant lower scores on post intervention ATEC as compared to children with ASD-nr.
Conclusions: Â Present study included clinic based sample of twenty children with ASD, out of whom 28% had history of developmental regression. Children with ASD and regression had similar functioning at baseline and had reduced autistic symptoms on three month follow up as compared to children with ASD and no history of regression. Small sample size, lack of an independent blind rater and post intervention assessment over telephone are the main limitations of this study. Strength of the study is the prospective nature of follow up. Long term follow up of these children is planned.

257 **181.257** Results of a RCT on a Transition Support Program for Adults with ASD: Effects on Quality of Life and Self-Determination

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Background:
There is a dearth of evidence-based services for people with autism spectrum disorders (ASD) as they transition into adulthood (Spain & Blainly, 2015). This often leads to poor outcomes with respect to independent living, vocational and community engagement (e.g., Howlin et al., 2004; Roux et al., 2015). Currently, the only RCTs on a comprehensive intervention for young adults with ASD evaluate the UCLA PEERS model (Gantman et al., 2012; Laugeson, et al., 2015; Van Hecke et al., 2016). However, PEERS requires caregiver involvement and assistance, which is not available to all adults with ASD, nor does it foster much needed independence (Hume et al., 2014).
Objectives:
We developed a manualized curriculum for a transition service for young adults with ASD (without Intellectual Disability). Instead of targeting predetermined skills, we empowered participants to identify skills they wanted to develop, a practice supported in the disability literature (Wehman et al., 2014). We surveyed participants' needs in three areas critical for successful adult transition: social communication, self-determination and working with others. Curriculum for each small group session reflected those participants' self-expressed needs. To evaluate the efficacy of this program we conducted an RCT with a delayed intervention control group, focusing on Quality of Life and Self-Determination outcomes (ClinicalTrials.gov:NCT02439671).
Methods: Â
Groups of 4 to 6 participants with ASD and 2 facilitators met for weekly for 2 hours over 10 weeks. Pre- and post- assessments were conducted within 4-6 weeks of the intervention by assessors blind to group status. Community diagnoses of ASD were confirmed with the ADOS-2.Â **RCT analysis:** 34 participants (aged 18 – 29) were randomized to immediate or delayed intervention. Groups did not differ on key demographic variables, nor baseline scores on Quality of Life (QoL-Q; Schalock & Keith, 1993) and Self-Determination (SDS; Wehmeyer & Kelchner, 1995) measures. **Pre-post analysis:**19 participants and 8 caregivers completed ratings of communication, self-determination, and working with others skills before and after intervention.
Results: Â
Two participants did not meet ASD criteria, and 6 did not complete all testing points, leaving 17 participants in the immediate intervention group and 9 in the delayed intervention control group. Intervention effects were investigated with Generalized estimating equations. There was a positive intervention effect on the QoL-Q, with the intervention group scoring on average 2 points higher than the control group, 95% CI [-.2, 3.9]. There was a strong positive intervention effect on a SDS subscale "Interpersonal cognitive problem-solving," with the intervention group scoring 2 points higher than the control group 95% CI [.082, 3.4]. Pre-post analyses revealed strong positive effects on participants' ratings of their own skills as 6 points higher post intervention, 95% CI [3.7, 8.6]. This was echoed by parent ratings of their child's skills as 7 points higher on average post intervention, 95% CI [1, 14].
Conclusions:
This is the first intervention study for adults with ASD targeting QoL and SD outcomes. Results show that in addition to improving skills focused on in the curriculum, important gains were made in QoL and SD during the intervention relative to control.

258 **181.258** Robotics Based Therapy in Chilean Children with Autism Spectrum Disorder (ASD)

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Background: Technology appeals ASD children. The use of this interest to help them improve socialization skills has received increasing research attention in the last decade (Dautenhahn, K. et al, 2002). Furthermore, special interest of ASD children for LEGO toys has been observed because they are highly structured, systematic and predictable. Studies have shown their usefulness when applied in the appropriate therapeutic context; they can decrease disruptive behaviors and improve social skills in ASD children, in a spontaneous and entertaining way, being less exhausting for patients and therapists (Legoff et. al 2006; Owens et. al 2008). However no data or results has been reported in the Chilean context.
Objectives: To determine whether robotics based therapy improves social skills in a group of Chilean ASD children under treatment in a Child Neuropsychiatry Hospital Service, representative of Chile´s context, because of its national referral center condition.
Methods: Cases and controls, prospective longitudinal study. 3 groups of 4 children with ASD diagnosis, confirmed with Autism Diagnostic Observation Schedule (ADOS); age higher than 9 years, normal intellectual coefficient with WISC (Wechsler intelligence scale for children). A group participated in workshops of LEGO Robotics (LEGOr-w), the second in workshops of social skills (SS-w) and the last one was not intervened. Both workshops lasted 10 sessions, and were performed once every two weeks
Results: 4 children of male sex in each group, average age: 11 years. Comparable groups. Vineland: significant differences in categories: socialization (p=0.002) and communication (p=0.039) comparing initial and final average scores of the 3 groups. No differences between groups (p>0.05, confidence level of 95%). Video coding: Children that joined LEGOr-w improved the following behaviors: initiation of meaningful conversation, autonomy for resolution of problems; less disruption to other, less echolalia, fewer episodes of discouragement or abandonment of the activity, however, these changes did not have statistical significance. Surveys: Statistically non-significant difference between scores of satisfaction surveys comparing initial and final assessments of parents and children in both workshops. Workshop attendance: Statistically significant difference in the attendance between the LEGOr-w and the SS-w (p=0.009), being the LEGO robotics group the one with better participation.
Conclusions: Better adherence to LEGOr-w, no differences in Vineland between groups, while the three improved. Novel intervention oriented towards users of Chilean public health system with restricted access to technology and limited offer of therapeutic interventions. Therapy aimed towards an age group where indifference attitudes have negative impact on interventions, contrary to the observations of this study sample. Further research could measure social behavior using the Gilliam Autism Rating Scale-2 in Spanish version and increase the total number of sessions and participants to observe the likelihood of improved socialization, as reported in literature. Maternal interviews in LEGOr-w final session reported improvement in fine motor skills of children; this could be measured in further robotics-based therapy research.

259 **181.259** Self-Esteem As a Mediator of Social Skills Improvement and Social Anxiety for Adolescents with Autism Spectrum Disorder (ASD) Following the UCLA PEERS® Program

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Background:
Studies suggest that teens with Autism Spectrum Disorder (ASD) have greater social impairment and are more likely to experience social anxiety while joining social groups (Brumariu & Kerns, 2008). Previous research has shown a positive relationship between social ability and self-esteem in typically developing youth (Lee & Robbins, 2000). Moreover, changes in self-esteem may trigger changes in social anxiety (de Jong, 2002; Rasmussen, & Pidgeon, 2011). The Program for the Education and Enrichment of Relational Skills (PEERS®) is an evidence-based, parent-assisted social skills treatment, which has been shown to improve social skills and reduce social anxiety in youth with ASD (Laugeson & Frankel 2010). However, self-esteem as a mediator of social anxiety and improvement in social skills following the UCLA PEERS® program has yet to be examined.
Objectives:
The purpose of this study is to examine self-esteem as a mediator of social skills improvement and social anxiety for adolescents with ASD following the UCLA PEERS® Program.
Methods:
Participants included 279 adolescents with ASD (64.2% Male=207; 25.8% Female=72) aging from 11-18 years (*M*=13.62, *SD*=1.95) and their parents. Teens and parents attended weekly 90-minute social skills groups at the UCLA PEERS® Clinic over a 14-week period. Social skills related to making and keeping friends as well as handling conflict and rejection were taught in a small group format. To assess improvement in social skills, parents completed the Social Responsiveness Scale-Second Edition (SRS-2; Constantino, 2012) at pre-and-post intervention, which measures adolescents' ability to interpret and respond to social cues. Adolescent self-esteem and social anxiety were assessed using self-reports on the Piers-Harris Self-Concept Scale-Second Edition (PHS-2; Piers, Harris & Herzberg, 2002) and Social Anxiety Scale (SAS; La Greca, 1998) at post-intervention. A Multiple Linear Regression was used to examine the relationship between changes in SRS-2 scores, and post-treatment PHS-2 and SAS scores, using self-esteem as a mediator variable.
Results:
Results suggest the existence of a mediating effect. Data indicates that changes in SRS-2 Total scores from pre- to post-intervention are positively correlated with SAS Total scores (p<0.01) and PHS-2 Total scores (p<0.01) following treatment. However, Multiple Linear Regression results indicate when self-esteem on the PHS-2 is used as a mediator, the relationship becomes insignificant (r=0.022; p=0.757). These results reveal that self-esteem plays a mediating role in the relationship between social skills improvement and social anxiety, with greater self-esteem mediating reduced social anxiety at post-intervention.
Conclusions:
The current research examined self-esteem as a mediator of social skills improvement and social anxiety for adolescents with ASD following the UCLA PEERS® Program. Findings suggest that self-esteem may act as a mediator between social skills improvement and social anxiety. Specifically, increased social ability appears to increase self-confidence in applying newly acquired social skills, thereby reducing social anxiety when engaging in social activities.

260 **181.260** Sex Differences in Adaptive and Social Behavior and Neural Responses to Biological Motion before and after Pivotal Response Treatment in Autism

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Background: Research on the clinical presentation of girls with ASD is mixed. Some evidence indicates that girls are more severely affected than boys; however, some girls with ASD may be missed by current diagnostic criteria (Kirkovski, M., Enticott, P.G., Fitzgerald, P.B., 2013; Howe, Y.J., et al, 2015). It is also unclear whether sex differences exist in treatment response.
Objectives: In a sample of young children with ASD, we compared social communication and adaptive skills as well as neural activation in key regions of social perception before and after a 16-week waitlist controlled trial of Pivotal Response Treatment (PRT).
Methods: Twenty-eight children, eleven girls, (mean IQ 96.32; SD 20.39; range 50-128) completed the 16-week trial of PRT. Twenty-one children, six girls, completed the waitlist condition (WLC) (mean IQ 97.00; SD 23.49; range 50-128). Furthermore, a subset of the PRT sample (13 boys, 7 girls) completed an fMRI before and after treatment. They viewed neuroimaging stimuli depicting point light displays of coherent biological or scrambled motion in a 3T scanner. Neuroimaging results were thresholded at Z>2.33 (voxel) and p<.05 (cluster). PRT is a naturalistic behavioral treatment focusing on improving children's social communication skills. PRT condition included 7 hours per week of individual work with the child and parent training. Clinical outcomes were assessed using the SRS-2, a parent report measure of social communication, and the Vineland Adaptive Behavior Scales-II, a semi-structured interview on adaptive functioning.
Results: At baseline, girls had significantly greater impairments in all domains of the Vineland-II (girls Communication mean 80.75, boys 91.588, p<.05; girls Daily Living Skills mean 74.833, boys 88.353, p<.05; girls Socialization mean 75.333, boys 82.47, p<.05; girls Adaptive Behavior Composite mean 76.167, boys 85.188, p<.05). Following treatment, girls' improvement on the ABC was significant (p<.05), whereas boys' improvement was not. After treatment, girls and boys exhibited no significant differences in adaptive functioning. At baseline, girls also had more pronounced social communication deficits than boys as assessed by the SRS-2. Girls' rate of improvement exceeded boys', although the magnitude of the differences was not significant (p>.05). Neither boys nor girls exhibited significant change in adaptive functioning or social communication following the WLC. Neuroimaging results were consistent with behavioral results: at pretreatment baseline, girls exhibited significantly less response to biological vs. scrambled motion than boys in the right inferior frontal gyrus (IFG) and right precentral gyrus (PG), key regions of social information processing. Following treatment, girls exhibited a greater gain in activation in the left fusiform gyrus (FFG), another key region involved in social perception. No regions showed a greater improvement in boys than girls.
Conclusions: Â Compared to boys, girls were more impaired at baseline and made more progress in adaptive functioning. Girls' social communication gains trended toward being significantly greater than boys'. Neuroimaging results were consistent with behavioral results. These findings are promising in that they suggest that girls, even if more impaired at baseline, respond favorably to treatment at the behavioral and neural level, possibly even more so than boys.

261 **181.261** Symptoms of ADHD, Depression, and Social Anxiety As Predictors of Social Skills Outcomes Among Adolescents with ASD Following the UCLA PEERS® Intervention

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Background:
Deficits in social skills, including impaired social-emotional reciprocity and poor nonverbal communicative behaviors, are common hallmarks for those with autism spectrum disorder (ASD) (Otero et al. 2015). These social deficits are often accompanied by deficits associated with other comorbidities that frequently occur in children with ASD (Leyfer et al., 2006). Among these comorbidities, anxiety, depression and Attention-Deficit/Hyperactivity Disorder (ADHD) are most common (Siminoff et al., 2008). Previous research on the UCLA Program for the Education and Enrichment of Relational Skills (PEERS®), an evidence-based social skills intervention for adolescents with ASD, demonstrates increases in social skills outcomes (Laugeson et al. 2012). While research suggests that ADHD, depression, and social anxiety are common symptoms yielding social deficits among adolescents with ASD, the extent to which these symptoms predict social skills outcomes following PEERS®requires examination.
Objectives:
The present study examines symptoms of ADHD, depression, and social anxiety as predictors of social skills outcomes among adolescents with ASD following a 14-week parent-assisted social skills intervention.
Methods:
Ninety-nine adolescents (males=81; females=18) with ASD ranging from 11-17 years of age (*M*=13.74; *SD*=1.65) and their parents participated in the study. Participants attended PEERS®, an empirically-supported parent-assisted social skills intervention. They attended 90-minute group treatment sessions over 14-weeks to learn guidelines related to the development and maintenance of social relationships. To assess baseline adolescent comorbidities, parents completed the Swanson, Nolan, and, Pelham Questionnaire-4thedition (SNAP-IV: Bussing et. al., 2008), which measures ADHD symptoms, and the Social Anxiety Scale (SAS; La Greca, 1999). Adolescents also completed the SAS at baseline, as well as the Children's Depression Inventory (CDI; Kovacs, 1992). Treatment outcome was assessed by examining parent- and adolescent-reported change in frequency of social engagement using the Quality of Socialization Questionnaire (QSQ; Frankel & Mintz 2008), and parent-reported change in social responsiveness on the Social Responsiveness Scale (SRS; Constantino, 2005) pre- and post-intervention.
Results:
Paired samples t-tests reveal significant improvement in number of adolescent-reported hosted (t=-5.22, p<.001) and invited (t=-2.50, p<.05) get-togethers from pre- to post-treatment. Results also reveal significant improvement in parent-reported social responsiveness (t=7.84, p<.001) over the course of treatment. Multiple linear regression was used to assess baseline ADHD, social anxiety, and depression symptoms as potential predictors of treatment outcome. Change in social responsiveness was not related to baseline ADHD-inattentive, ADHD-hyperactive/impulsive, depression, or social anxiety scores (p>.10; R^2=.009). These baseline scores were also not predictive of change in hosted get-togethers (p>.10; R^2=.005). ADHD-inattentive, social anxiety, and depression baseline scores were not predictive of change in invited get-togethers (p>.10), but ADHD-hyperactive/impulsive baseline scores predicted less improvement at a trend-level significance (p<.10; R^2=.075).
Conclusions:
Findings reveal that baseline ADHD, depression, and social anxiety symptoms are not predictive of improvement in social responsiveness or frequency of social engagement following the PEERS® intervention. However, a trend level significance was found for ADHD-hyperactive/impulsive youth, who presented with slightly less social reciprocity through invited get-togethers from peers.

262 **181.262** How Perceived Financial Strain Impacts Autism Support Teachers

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Background:
School-age children with autism receive most of their intervention in schools. In under-resourced, urban school districts, teachers tasked with providing students with evidence-based practices often receive low salaries. These low salaries may lead to turnover (Miller et al. 1999) and financial strain (Prawitz et al. 2006)—when one is unable meet his/her financial responsibilities. Previous research suggests that financial strainÂ increases intentions to quit one's job (Adams et al. 2016), reduces commitment to employers and increases absenteeism (Kim & Garman, 2003), worsens physical health (O'Neill et al., 2006), and increases depression (Starkey et al. 2013). To date, no research has examined whether financial strain increases teacher turnover or use of evidence-based practices, a finding that would have important policy implications.
Objectives:
To examine whether teachers' perceived financial strain is associated with turnover, their intentions to implement EBPs for students with autism, and the quality and frequency of EBP implementation.
Methods:
The sample included 52 kindergarten-through-second-grade autism support teachers employed in one urban school district. All participants were enrolled in a multi-year randomized, controlled trial; data for this study was collected as a part of the larger trial. All teachers received training in five EBPs for children with autism: discrete trial training, pivotal response training, data collection, positive reinforcement, and visual schedules. Teachers completed the InCharge Financial Distress/Well-Being Scale, a 10-item questionnaire designed to measure a person's perceived financial strain. Items ranged on a scale of 0 = No financial distressÂ to 10 = overwhelming financial distress. An example itemÂ is "How often do you worry about being able to meet normal monthly living expenses?" The Intent to Implement measure is a 114-item questionnaire measuring teachers' intentions to implement EBPs for students with autism. Several scales, ranging from 1 to 7 were used. An example item is "Think about you …running discrete trial training with most students, at least 3 days a week, for the next 3 months. For me to do this would be…" Teachers' quality and frequency of usage for each EBP was measured through monthly teacher self-report and bimonthly observations. Turnover was defined as teachers leaving their position. The school district provided information about turnover at the start of the following school year.
Results:
Data collection is complete and analyses are underway. Linear regression models will be used to estimate the extent to which teachers' perceived financial strain is associated with their intended and actual use of EBPs. Logistic regression will be used to answer the extent to which teachers' perceived financial strain is related to their turnover.
Conclusions:
The results will lead to a better understanding of how teachers' perceived financial strain impacts their intentions to implement EBPs, fidelity to the EBPs, and sustainment of EBPs in urban public schools. Given the pressing need for EBPs in school settings, this study will provide insight into barriers affecting EBP implementation in resource-limited schools.

263 **181.263** Tailoring Eye Tracking to Specific Targets of Pivotal Response Treatment (PRT): Preliminary Results from Novel Eye-Tracking Tasks in Children with and without ASD

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Background: Eye tracking has been used for almost 15 years in autism research but has only recently begun to advance as a viable method for monitoring clinical treatment(Dawson et al, 2010). In an ongoing study, we aim to track change in response to evidence-based behavioral treatment, PRT, through eye tracking. Here we report preliminary results from novel paradigms developed to measure specific PRT intervention targets, including a Dyadic Bid task(DB) examining sensitivity to overtures for engagement, a Conversation Following task(CF) examining conversational engagement, a Social Referencing task(SR) examining monitoring of nonverbal information, and a Theory of Mind task(ToM) examining perspective-taking.
Objectives: To explore baseline between-group differences in children with and without ASD in performance on four novel eye-tracking paradigms tailored specifically to assess change following PRT.
Methods: Participants included thirty-six 4 to 8 year-olds, ASD *n*=14 (11 males, M_{DQ}=88.4 sd=19.8) and non-ASD *n*=22(13 males; M_{DQ}=108.9 sd=12.4). A joint DB and CF task included clips of actors engaging in naturalistic conversation. During each clip, an actor turned to the camera and performed a bid for the participant's attention (question or statement) then paused as though waiting for a response. DB main outcome measure was proportion of time looking at the bid actor's face(*BidActor%*), and for CF, the proportion of time looking at the speaking actor(*Speaker%*). SR included clips of an actor performing an increasingly stressful task(e.g. inflating a balloon until it pops). SR outcome measure was proportion of time looking at the actor's face(*Face%*) and activity(*Activity%*) during the event escalation and resolution. ToM included a hide-and-seek false belief task. ToM outcome measure was proportion of time looking in the hiding place associated with the protagonist's false belief(*FalseBelief%)* and where the target object was actually hidden(*TrueLocation%)*. Univariate ANCOVAs controlling for DAS-II GCA Standard Score were conducted to examine main effects of diagnosis(dx).
Results: *DB:* There was a significant main effect of dx on *BidActor%* during the pause following bids($F(1,36)=6.3$, $p<.05$, $\eta_p^2=.16$), and during bids that were statements($F(1,36)=4.9$, $p<.05$, $\eta_p^2=.129$), with the ASD group looking less. *CF:* There was a significant main effect on *Speaker%*($F(1,36)=4.96$, $p<.05$, $\eta_p^2=.13$) with the ASD group looking less at the speakers. *SR:* There was a significant main effect on *Face%* during the event's resolution($F(1,36)=4.3$, $p<.05$, $\eta_p^2=.115$), and a trend toward a main effect on *Activity%* during the escalation($F(1,36)=3.6$, $p=.066$, $\eta_p^2=.098$) with the ASD group looking less at face and activity. *TOM:* There was a trend toward a main effect on *TrueLocation%*($F(1,36)=3.3$, $p=.078$, $\eta_p^2=.094$) with ASD looking more at the true location. There was no main effect on *FalseBelief%*.
Conclusions: Preliminary between-group differences provide initial validity for these novel eye-tracking paradigms. Children with ASD appear to be less sensitive to overtures for social engagement, particularly during more socially-nuanced bids. They also exhibit decreased monitoring of speakers' faces during conversation, and less referencing of another's face following the culmination of a stressful event. Results from ToM may reflect a deficit in perspective-taking within the ASD group. Further study is needed to assess the ability of these paradigms to measure within-subject change in response to PRT.

264 **181.264** Teaching Adults with Autism Spectrum Disorder Responses to Non-Verbal Pragmatic Behavior

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Background: One common challenge discussed in the literature for individuals with autism spectrum disorder (ASD) is in area of recognizing and responding to non-verbal pragmatic cues during social interactions. The use of intervention strategies such as self-management and the incorporation of visual prompts have been empirically supported as effective strategies for improving an array of social skills for adults with ASD.
Objectives: The purpose of the present study was to use self-management and question-asking intervention strategies and to assess the efficacy of the intervention with respect to teaching adults with ASD to recognize and respond appropriately to specific pragmatic behaviors, with the goal of enhancing their social interactions.
Methods: A multiple baseline across participants design was used to assess the efficacy of an intervention for adults who demonstrated a lack of responding to their communicative partners' nonverbal pragmatic behaviors. Participants were taught to ask specific, relevant questions in response to their conversation partner's nonverbal expressions of boredom and confusion. The intervention included clinician modeling of the expression, creation of a question bank for each expression, and practice with self-management for responding to each pragmatic expression. Conversations were video recorded during baseline, intervention, and follow up sessions, and responses to each pragmatic cue was coded as appropriate or inappropriate, yielding a percent of appropriate responses for each pragmatic expression in each session.
Results: Participants showed substantial gains in responding appropriately to targeted pragmatic behaviors during social conversation after beginning the intervention. Moreover, this skill generalized to novel conversation partners and maintained after terminating the intervention. Additionally, the Empathy Quotient (Baron-Cohen & Wheelwright, 2004) scores improved from pre- to post-intervention, lending support to the social validity of this intervention.
Conclusions: An intervention which utilizes modeling, question banks, and self-management can be effective in teaching recognition of, and appropriate responses to, pragmatic social cues for adults with ASD. Improved performance in this skill likely contributes to benefits in their social communication overall.

265 **181.265** Teaching Goal Attainment to Young Adults with Autism Using Self-Regulated Problem-Solving Strategy

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Background: Research examining interventions to teach skills that lead to self-determination to people with autism spectrum disorder (ASD) is rare. Self-determination has been found as one of the predictors of successful adult life. Given poor adult outcomes and scarcity of research on interventions for young adults with ASD (Newman et al., 2011; Shattuck et al., 2012), examining ways of supporting youth with ASD and teaching skills that lead to self-determination is one important step to contributing to improved adult outcomes. One such strategy, self-determined career development model (SDCDM) focuses on teaching students to set goals, make plans for improvement, and evaluate/adjust goals through self-regulated problem-solving process. This session will present the findings of the study examining the effects of SDCDM on goal attainment of a young adult with autism. The presentation will provide attendees with the strategies for teaching youth with ASD self-regulated problem-solving process to set goals, make action plans, and evaluate and adjust goals based on progress.
Objectives: The purpose of this study was to determine the effects of SDCDM on goal attainment of a young adult with autism when working towards career-related goals. Research questions were: (1) To what extent does a young adult with ASD improve performance toward self-selected career-related goals using SDCDM? (2) To what extent does a young adult with ASD maintain performance toward self-selected career-related goals following the use of SDCDM?
Methods: A multiple probe across three goals design of single-case experimental methodology was used to determine the effectiveness of the intervention on goal attainment and skill maintenance of a young adult with ASD. Using phase one of SDCDM, the participant generated three goals he wanted to work on during the project. Once goals were selected, the participant worked through phase two of the model to come up with student-directed strategies for each goal. Young adult participated in a minimum of five baseline sessions per goal, 8-10 intervention sessions, and three follow-up sessions. Data were analyzed using the recommended approaches for single-case experimental data: visual analysis analyzing for trend, level, variability, magnitude of effect and effect size calculation to determine the existence and magnitude of a causal relationship between an intervention and target skills (Kratochwill et al., 2013).
Results: Results supported the effectiveness of SDCDM in teaching a young adult with ASD to problem solve to set career-related goals, make action plans, and evaluate progress towards self-selected goals. The young adult showed immediate improvement in goal attainment from baseline to intervention phase and maintained performance with 100% accuracy. The young adult's supervisor in a community setting and behavior specialist also noted the participant's progress and held positive perceptions toward the use of self-regulated instructional strategies.
Conclusions: The findings add to scarce research in teaching young adults with ASD using self-regulated problem-solving process and student-directed instructional strategies. As an applied research study conducted in the field, findings demonstrate how professionals can design and implement self-regulated instructional strategies to support skill acquisition and learning of young adults with ASD.

266 **181.266** The Benefits of Using a Telehealth Service Delivery Model to Improve Communication Skills in Children with Autism Spectrum Disorder.

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Background:
Computerized technologies, video modeling, and robots, are reported to be reinforcing for many children with Autism. The use of computer-assisted instruction and videoconferencing platforms (i.e., telepractice) have become very popular to deliver a variety of services to individuals with autism. A systematic review of the literature during the 1994 - 2016 period regarding the use of telepractice to improve or enhance communication skills in individuals with autism and/or to train families to facilitate language development in young children with autism, revealed that only 3 studies among the total of 53 specifically investigated the effects of delivering Speech Language Pathology (SLP) intervention services to children with autism. Published research over the past 22 years supports positive outcomes of using telepractice to improve early identification of autism, parent/guardian training for early intervention, and applied behavioral therapy services for children and individuals with autism.
Objectives:
1) To empirically investigate student outcomes using a telepractice platform compared to on-site services to deliver speech and language intervention to students with autism between the ages of 9 to 12 years; and 2) To empirically study the effectiveness and satisfaction of using telepractice as a service delivery method among 3 cohorts of participants: a) the 7 children with autism receiving speech language services; b) 9 pre-professional masters SLP graduate clinicians enrolled in a specialty training program in autism, and c) 3 SLP supervisors.
Methods:
An alternating ABA single case time-series research design (Kazdin, 2011) was utilized. Participants included 7 middle school-aged students on the autism spectrum between the ages of 9 to 12 years. Individual and group comparisons were conducted to evaluate student outcomes (Dependent variables) when SLP services were delivered using telepractice vs. on-site vs. telepractice (Independent variables) (TeleTx vs. On-site vs. TeleTx). The 7 students with autism, 9 pre-professional SLP graduate students, and 3 SLP supervisors completed satisfactions surveys at the end of the three service phases.
An equal number of intervention services for the 7 students were delivered in 3 six-week phases: TeleTx-Onsite-TeleTx. The 9 formally trained SLP graduate clinicians delivered the services using stimuli and activities created using the Smart Notebook (Smart Technologies) software applications for each student's intervention program targeting students' treatment goals and objectives. The clinician-student dyads remained constant, as did the computer technologies and software used for intervention
Results:
Comparable outcomes and no significant differences were observed in student performance when SLP services were delivered using telepractice compared to on-site face-to-face. Significant individual and group differences were observed in the number of prompts and reinforcers during intervention when services were delivered via telepractice. Students with autism required a greater number of prompts and reinforcers during speech language therapy when delivered on-site compared to telepractice. A five-point satisfaction survey ranging from 1 (strongly disagree) -5 (strongly agree), yielded a median score of 4 for 7 students with autism; 4 for 9 SLP graduate students; and 4 for SLP supervisors.
Conclusions:
Speech and language intervention outcomes were comparable when services were delivered to students with autism using telepractice vs. on-site.

267 **181.267** The Effects of Mindfulness Practice on Psychological Wellbeing in Mothers of Children with ASD: A PILOT Study

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Background: Mothers of children with ASD report high levels of psychological stress, significantly lower sense of self-efficacy about parenting their child with ASD, and higher levels of stress and depressive symptoms compared to mothers of children who are typically developing. Others have found lower levels of life satisfaction, social support, and self-esteem compared to controls. Aspects of the child's diagnosis, lack of service delivery, and daily challenges in care can negatively impact wellbeing. Practicing mindfulness has been shown to reduce stress among vulnerable populations, but such interventions have only recently been examined among mothers of children with ASD. A meta-analysis of mindfulness studies found that of 18,756 studies on mindfulness practice, only a small number fit the standards of scientific rigor because of the absence of either control or comparison groups, or both. This study contributes to the research on mindfulness as a means to increase maternal wellbeing and fill the gap in the literature by incorporating a comparison and control group.
Objectives: This study examines the effectiveness of mindfulness practice on self-esteem, self-efficacy, psychological wellbeing, parenting stress, and life satisfaction among mothers of children with ASD. We also set out to examine group differences across mothers participating in three groups: (1) a mindfulness practice intervention, (2) a discussion-based intervention, and (3) no-intervention controls.
Methods: Twenty-seven mothers were assigned to groups: mindfulness (*n* = 11), discussion-based (*n* = 6), or control (*n* = 10). Mothers in the mindfulness and discussion-based groups attended 8 weekly sessions for 90 minutes. Mindfulness intervention focused on breath counting, seated meditation, body scans, and loving-kindness practice. The discussion-based group served as a comparison for the mindfulness group, focusing on discussions about parenting children with ASD. Controls received no intervention during the 8-week period. All participants completed the following pre- and post-intervention measures: Rosenberg self-esteem scale, Generalized Self-Efficacy scale, Ryff Scales of Psychological Well-being, Parental Stress scale, and Satisfaction with Life scale. In addition, individuals in the mindfulness and support groups participated in focus group interviews after the 8-week intervention.
Results: Z scores were computed for pre-posttest comparisons. The results suggest significant differences from pre- to post-intervention for the mindfulness group on perceived: satisfaction with life, self-esteem, self-efficacy, psychological wellbeing and subscales of autonomy, environmental mastery, personal growth, positive relations, and purpose in life. There were no significant results for the discussion-based and control groups (with the exception of the purpose in life subscale for controls). No significant results were found for parental stress. Results from qualitative focus groups provide support for the pre-post test comparisons. These results suggest that while the subjective experience of parenting stress was not significantly affected by the intervention, participants in the mindfulness group developed considerable acceptance of their life circumstances, as well as practical tools to cope with the uncertainties of stressful parenting.
Conclusions: Findings support the utility of mindfulness practice for increasing aspects of psychological wellbeing. Perceptions of parental stress did not decrease. Mothers of children with ASD can benefit from low cost, non-medical, and readily accessible mindfulness programs.

268 **181.268** The Impact of Self-Regulation Skills on Academic Outcomes in Minimally-Verbal School-Age Children with Autism

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Background: Self-regulation skills predict positive long-term academic and social outcomes in typically developing children. Children with autism often have difficulties in the area of self-regulation, particularly children with autism who are minimally verbal.
Objectives: Our primary aim was to examine whether self-regulation skills at baseline moderate academic outcomes in minimally-verbal children with autism compared with children with autism with typical expressive vocabulary.
Methods: Out of 137 children with autism who participated in school-intervention trial, 10 (7%) met minimally-verbal (MV) criteria (DiStefano et al., 2016, *Autism Research*; < 20 words) and 43 (31%) met typical expressive vocabulary criteria (TEV; t score 40-60 on Differential Abilities Scales (DAS) Picture Naming sub-test). The MV and TEV groups were rated on the frequency of their self-regulation difficulties by researchers after a standardised observation and their academic abilities (DAS standard score) were measured at the start and end of the school year (T1 and T2, respectively).
Results: Â As expected, the MV group had more frequent difficulties in self-regulation than the TEV group at the start of the school year (see Figure 1). Contrary to expectations, after controlling for DAS T1 scores, the only significant predictor of DAS T2 scores was self-regulation difficulties at T1, *b*Â = 5.24,Â *t*(48) = 2.44,Â *p*= .02, with more frequent self-regulation difficulties predicting *greater* academic gains. To understand this further, we examined within group correlations between self-regulation difficulties at T1 and DAS changes scores (DAS T2 – DAS T1). Results showed that the above prediction was driven by the TEV group (*r*(41) = .42,Â *p*Â < .01; see Figure 2) rather than the MV group (*r*(8) = .39,Â *p*Â < .27).
Conclusions: Â Results suggest an unusual relationship between self-regulation difficulties and academic outcomes in children with autism with typical expressive vocabulary, which may be indicative of the impact of self regulation difficulties on the accuracy of academic test scores for children at the beginning of the school year. These preliminary results will be followed up in an additional sample of over 400 children with ASD.

269 **181.269** The Job-Train Program: A Community-University Employment Preparation Initiative for Youth with ASD

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Background: Â Evidence shows that the unemployment rate in adults with ASD is estimated at 75-90%. We also know that earlier job experiences predict better employment outcomes. Secondary school co-op programs aim to provide early job experience; however, challenges exist in providing successful co-op experiences and integrating acquired skills across contexts (home, school, and community). A unique employment program (Job-Train Program; JTP) was developed from a partnership between a Canadian university, a community agency, and a local school board. The JTP is a 14-week program that includes: (1) weekly coach-facilitated group sessions providing an individualized curriculum and support; (2) paid 9-week summer job placement within the university.
Objectives: Â To implement a "Proof-of-Concept" project for the Job Training Program in a sample of secondary school students with ASD.
Methods: This mixed-methods study used a pre-post design to examine the program outcomes in 12 secondary school students with ASD, and gather insights from parents, job coaches and employers within the JTP. Quantitative data for outcome evaluation were analyzed using either parametric or non-parametric analyses, depending on whether data followed a normal distribution. Primary measures included the Canadian Occupational Performance Measure (COPM; youth completed) and the Child Behavior Checklist (CBCL; parent report). Qualitative data were also collected from youth, parents, job coaches and employers regarding their perspectives on the JTP. Qualitative data were analyzed using content analyses of the transcripts from audio-recorded focus groups and individual interviews.
Results:
The sample consisted of 12 youth with ASD (83% males; mean age 17 years). JTP job placements involved the following university departments: housing and conference services, health sciences library, faculty services, and several health science academic departments and research centres.
The total issues identified by youth in the COPM (self-care, work and leisure) ranged from 1-7. Based on the Wilcoxon Signed Ranks test, pre- and post-JTP COPM weighted mean ratings for performance and satisfaction were z= -2.67, p=.008 and z=-2.60, p=0.009, respectively. For the CBCL, there were no significant differences for paired t-tests of pre-post scores for both internalizing and externalizing behaviours, t(8)=.583,p=.576 and t(8)=.629, p=547, respectively.
Qualitative data from parents revealed the following themes:
(1) Perceived benefits of JTP - "fitting in with peers," "improved self-perception," and "motivation for more responsibility at home and in the community."
(2) Â Valuable attributes of JTP – "relevant curriculum," "independence skill opportunities supported outside JTP," and "importance of 'real' and 'paid' work."
(3) Future JTP considerations – "job placements outside of university," and "increase length of work day as placement progressed," "include parent education for support/advocacy."
Conclusions: This study successfully implemented a job training program with the essential elements of individualized supports and programming, weekly coached group sessions and strong community partnerships (agency, school board and university). This study provides useful preliminary results that, despite a small sample size, suggest improvement in issues related to employment skills and independence. Results of this "Proof-of-Concept" study will guide the refinement of the JTP protocol and future work on involving a large-scale study examining its utility and effectiveness in youth with ASD.

270 **181.270** The Labour Market Experience of Women with High Autistic Traits

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Background:
Unemployment and underemployment are asserted as issues adversely affecting the economic, health, and social circumstances of women, and in particular individuals with High Autistic Traits (HATs; including those with Asperger's or high functioning Autism). However, little research has been published regarding the labour market experiences of women with HATs.
Objectives:
To compare the labour market experiences of women with HATs to women with low autistic traits (LATs) and men with HATs.
Methods:
An anonymous online survey targeting women with Autism was conducted. Qualitative data was analysed using thematic analysis with an inductive process. Subsequent categories, as well as quantitative data, was analysed using chi square.
Results:
Ninety-nine women aged 18 to 62 years responded to the questionnaire: 69 with HATs aged 18 to 60 years (M=35.51, SD=10.08), and 30 with LATs aged 19 to 62 years (M=38.10, SD=10.09). Also, 53 men aged 20 to 68 years responded: 31 with HATs aged 20 to 68 years (M=44.50, SD=12.76), and 22 with LATs aged 23 to 61 years (M=38.64, SD=8.99).
It was found that women with HATs, compared to women with LATs, reported greater instances of negative employment histories ($\chi^2_{(1)}$=16.40, p<.001, ϕ=.41) and frequent and/or being "stuck" in underemployment situations ($\chi^2_{(1)}$=8.66, p=.003, ϕ=.40). Further, among both women and men, compared to those with LATs, those with HATs were more likely to report difficulties maintaining employment (women, $\chi^2_{(1)}$=4.82, p=.028, ϕ=.22; men, $\chi^2_{(1)}$=7.94, p=.005, ϕ=.39) and were less likely to describe their employment history as stable (women, $\chi^2_{(1)}$=9.40, p=.002, ϕ=.31; men; $\chi^2_{(1)}$=14.35, p<.001, ϕ=.52).
Notably, there was a significant difference between women with HATs compared to men with HATs regarding entry into the labour market. In addition, men with HATs reported barriers that were not significant for their female counterparts.
Conclusions:
Both autistic traits and sex may influence labour market prospects and workplace experiences. Therefore, support for adults with HATs, including the provision of reasonable adjustment in the workplace, need to take into account both an individual's level of autistic traits and their sex.

271 **181.271** The Mediating Role of Teaching Quality and Student Engagement Between Teacher Mental Health and Learning Outcomes of Students with ASD.

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Background:
Children with autism spectrum disorder (ASD) are entitled to free and appropriate education in public schools. Teachers play a critical role in delivering educational support for students with ASD on a daily basis. However, teachers of students with ASD report more stress and burnout compared to teachers of students with other disabilities (Kokkinos & Davazoglou, 2009). Despite the attention to burnout and stress, the actual influence of teacher burnout and stress on the learning outcome of students with ASD remains unclear.
Objectives:
(1) To understand the effects of burnout and stress on teaching quality, student engagement, and individual educational program (IEP) outcomes of students with ASD.
(2) To understand the mediating roles of teaching quality and student engagement between teacher burnout and stress and IEP outcomes of students with ASD.
Methods:
Seventy-nine dyads consisting of a special education teacher and one student with ASD selected randomly from each teacher's caseload were recruited. Teachers' levels of stress and burnout, including emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA), teaching quality, and student engagement were collected using standardized measures at the beginning of the school year. The students' progress on the IEP goals were tracked throughout the school year using Psychometric Equivalence Tested Goal Attainment Scaling (PET-GAS; Ruble et al., 2013).
Results:
Effects of burnout and stress on teaching quality and student engagement. Multivariate regressions showed that teacher stress was the only significant predictor of both decreased teaching quality (*b* = -.07, *t*(54) = -3.08, *p* = .003; *F*(4, 54) = 3.41, *p* = .015) and of decreased student engagement (*b*Â = -.03,Â *t*(66) = -2.82 ,Â *p*Â = .031, *F*(4,66)= 2.21, *p* = .078).
IEP outcomes. PA was the only significant predictor (*b*Â = .06,Â *t*(60) = 2.90,Â *p*Â =.005) of student IEP outcomes, *F*(1,60) = 6.70, *p* < .001.
The mediating role of teaching quality and student engagement. Despite having no direct influence, entered in parallel, stress, EE, and DP influenced IEP outcomes either through student engagement alone or through student engagement and teaching quality (indirect effect = -.001—-.05, *SE* = -.22 - .001, 95% *CI* = -.21—-.0001). PA had only a direct influence on student IEP outcomes (see Figure 1).
Conclusions:
One of the three burnout subscales (PA) was negatively and directly related to achievement of long-term IEP outcomes for students with ASD. In contrast, stress, EE, and DP, had indirect effects on student IEP outcomes either through student engagement alone or through teaching quality and student engagement together. The results not only document a direct impact of teacher burnout and stress on student learning outcomes, but also provide preliminary documentation of potential mediating mechanisms between burnout and stress and student learning outcomes. The results suggest that stress management and mental health should be addressed in pre-service and in-service training, and in evidence-based programs for students with ASD in school.

272 **181.272** The Quality of High School Programs for Students with ASD from 3 States

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Background:
According to the National Autism Indicators Report the outcomes for young adults with autism spectrum disorders (ASD) are grim (Roux, Shattuck, Rast, Rava, & Anderson, 2015), and information about the quality of preparation from high school and transition programs serving the increasing number of adolescents and young adults with ASD is scare.
Objectives:
What is the overall quality of high school programs for students with ASD?
What are the areas of strength and weakness in the quality of high school programs in the US for students with ASD?
Do ratings on of the quality of the transition plans on a checklist differ between plans written for students with ASD who will receive a diploma compared with those who participate in an alternative program during high school?
Methods:
Program quality was measured using the Autism Program Environmental Rating Scale (APERS) in 60 high schools participating in a RCT in 3 states (North Carolina, Wisconsin, & California) as part of the Center on Secondary Education for Students with Autism Spectrum Disorders (CSESA). Prior to intervention, the APERS was completed in each school. The APERS-HS is a 66-item, five-point rating scale, with a score of 1 (lowest) to 5 (highest). The APERS ratings are calculated into a total score and 11 sub-domain scores and 1 composite rating for Transition (consisting of items in different domains). The APERS process involves 6 to 8 hours of observation, interviews with administrators, parents, and school personnel, and a record review of the student's IEP and transition plan. The APERS was completed and scored separately for programs where students will receive a diploma and those who follow an alternative or modified curriculum. Inter-rater agreement between two observers/raters using Cronbach's Alpha was .94 for the diploma programs and .95 for the alternative programs. The quality of the transition plans of select students in both diploma and alternative programs will be rated using a modified checklist developed by the state of Maryland.
Results:
The overall ratings for the programs were in the moderate/mediocre range (3.17 for diploma and 3.25 for modified). The results by domain were similar for both diploma and alternative programs with the learning environment, climate, and family involvement scoring above 3.0 and were relative strengths of the programs. Ratings of instructional approaches that focused on areas that tend to be the most needed by students with ASD (social, communication, independence, functional behavior) were uniformly below 3.0. Transition composite scores, also below 3.0, were somewhat higher in the modified classes (2.7) as compared to the diploma (2.35). Future analysis of the ratings from the transition plan checklist will provide information about possible factors that contribute to these overall low Transition scores and differences by program type.
Conclusions:
Overall schools had a medium level of quality. The program strengths were ecological features and family involvement. The lowest ratings of quality were for instructional and intervention practices. Transition practices were quite low overall, with lower ratings occurring in diploma programs.

273 **181.273** The Use of Positive Reframing to Reduce Negative Statements in Adolescents with ASD

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Background: Individuals with Autism Spectrum Disorder (ASD) often experience impaired social communication skills. With these difficulties, social isolation can occur which may lead to comorbid disorders such as depression and anxiety (Shtayermman, 2006; Ryden & Bejerot, 2008). New research shows that children with ASD are also susceptible to comorbid disorders such as depression and anxiety (Strang, J., F., Kenworthy, L., Daniolos, P., Case, L., Wills, M., C., Martin, A., & Wallace, G., L., 2012). Not many early interventions are targeting these comorbid disorders at this age (Simonoff, E., Pickles, A., Charman, T., Chandler, S., Loucas, T., Baird, G., 2008). Parents and educators report strained friendships with peers, name calling or bullying. These increased levels of negative affect and commenting may create difficulties in social conversation and establishing meaningful relationships. Positive reframing is the ability to perceive something previously viewed as negative in a positive light (Lambert, Fincham, & Stillman, 2012). It is empirically validated as a beneficial treatment for a range of psychological conditions, including; Depression (Lambert, 2010), Anxiety disorders (Goldin et al., 2012), Depression/anxiety in parents of children with ASD (Benson, 2010). This intervention aims at using positive reframing to increase social communication skill levels for adolescents with ASD.
Objectives: To use positive reframing to effectively decrease the use of negative statements while reframing into neutral or positive statements during social conversations for adolescents with ASD. A second objective included if collateral improvements would be gained in affect/interest during social conversation.
Methods: Participants included three adolescents, ages 9, 11, and 14, diagnosed with ASD. Participant selection criteria included making excessive negative comments to their conversational partner during at least 20% of intervals in 10-minute conversational probes. A multiple baseline design was used along with partial interval recording. Behavioral measures that were coded and analyzed included; negative/positive/neutral statements and affect. For intervention, a combination treatment package was implemented. This included defining reframing, video feedback monitoring and self-management of reframing. Participants were required to reach 80% fidelity before continuing onto each step.
Results: Findings indicated that it is possible to each adolescent with ASD to effectively decrease the use of negative statements while reframing during social conversations with peers. Participant 1 decreased average negative statements from 25% to 2%, participant 2 decreased average negative statements from 24% to 4% and participant 3 decreased average negative statements from 22% to 5%. All three participants saw gains of positive or neutral statements around 15% of conversation, likely to typical range. Results also found that the use of positive reframing raises child affect along with collateral effects where peers have higher affect during social conversation.
Conclusions: Â Implications of this intervention show that the use of positive reframing can improve social interactions and develop meaningful friendship and romantic relationships. Positive reframing may also be useful for adolescent's future in accessing and maintaining employment as well as targeting decreasing symptoms of depression and anxiety. These are applicable techniques that can be used by parents, teachers, and clinicians across a variety of social conversations and settings.

274 **181.274** Therapy Satisfaction As a Predictor of Parent Improvement Following Cognitive Behavioral Therapy for Children with Autism Spectrum Disorder

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Background: Parents of children with autism spectrum disorder (ASD) can experience significant stress, anxiety and depression (Estes et al., 2009). There is evidence that parent involvement in child-focused therapy may indirectly improve parent functioning (Silverman et al., 2009), but little research to elucidate factors contributing to this change. For family CBT programs, aspects of the therapy experience, such as parent engagement, have been shown to be associated with improved child outcomes (Podell & Kendall, 2010), and for adult participants in therapy, program satisfaction is also related to symptom reduction (Atkisson & Zwick, 1982). As such, it may be useful to examine the therapy experience when investigating predictors of change for parents.
Objectives: Â The current study aimed to test whether post-intervention changes in parent mental health were predicted by program experience ratings, controlling for parents' pre-intervention scores.
Methods: Â Participants included 52 parents (82.7% mothers*; M* age=43.5, *SD*=4.2) of children with ASD participating in a randomized controlled trial of CBT, targeting child emotion regulation. To assess mental health, parents completed the self-report *Depression Anxiety and Stress Scale*(DASS-21, Lovibond & Lovibond, 1995) at baseline and immediately following intervention. To assess therapy experiences, parents completed post-intervention surveys that asked about a) their level of confidence supporting their child, b) perception of child change due to intervention involvement, c) satisfaction with therapist, d) mean satisfaction with pragmatic aspects of the program (location, session length, dates/times program was offered), and e) their child's enjoyment of the program. Responses were provided on a scale from 0 (not at all satisfied) to 5 (very satisfied). To test whether therapy experiences predicted change in parent functioning, a series of multiple regressions were calculated to predict post-intervention DASS scores, each entering the pre-intervention DASS score and one of the therapy experience measures as predictors.
Results: Post-intervention, there were significant improvements in parents' reported depression ($t(49)=2.23$, $p=.03$), and there was a trend toward improvement in total DASS ($t(49)=1.74$, $p=.09$). After controlling for pre-intervention total DASS scores, parent confidence emerged as a significant predictor, explaining 10% of the variance in post-intervention total DASS scores ($t(41)=-2.22$, $p=.03$). There was also a trend toward parent ratings of program pragmatics being a predictor of post-intervention DASS total scores ($\Delta R^2=.10$, $t(41)=-2.00$, $p=.06$). Additional trends emerged when examining post-intervention depression, with program pragmatics ($\Delta R^2=.14$, $t(41)=-1.94$, $p=.06$), and parent perception of child change ($\Delta R^2=.16$, $t(41)=-1.96$, $p=.06$) predicting post-intervention depression scores.
Conclusions: Â Improvements in overall parent mental health and depression following participation in a family-based CBT program were related to their perceptions of therapy. Though correlational, results support the hypothesis that parents' experience of their child's treatment may impact how they benefit from an intervention (Osbourne et al., 2008). The results of the current study provide further support for this model and will be discussed with regard to implications for intervention development and evaluation.

275 **181.275** Training School-Based Consultants to Conduct Data-Based Functional Assessments

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Background:
For students with autism spectrum disorders (ASD), untreated school-based behavior challenges can reduce a student's access to the least restrictive environment, limiting a student's learning and social opportunities. Functional behavioral assessment (FBA) is an evidence-based practice in which information is systematically gathered to determine the underlying function or purpose of a behavior to inform behavior intervention programming (Wong, et. al., 2014). Even when practitioners understand the importance of function-based interventions for challenging behaviors, their skill and confidence deficits may prevent them from incorporating valid data within the FBAs they are required to develop and implement.
Objectives:
Based on the work of Bassingthwaite, Casey, Wacker and colleagues, the current study was designed as a small-scale replication in which 8 school-based consultants were provided with behavioral skills training on two direct assessment techniques, preference assessments and descriptive behavior assessments, to improve the quality of their FBAs for students. The primary study objective was to measure the impact of behavioral skills training on trainees' knowledge of the FBA process, procedural fidelity and confidence in completing both preference assessments and descriptive behavior assessments, and utilization of data for improving the effectiveness of behavior interventions.
Methods:
Behavioral skills training using a combination of live and telepresence support was conducted across two consecutive years to teach trainees how to plan, conduct, and analyze preference assessments and descriptive behavior assessments and to synthesize assessment results into a valid and complete FBA. Trainees were administrated a questionnaire to assess their knowledge, confidence, and utilization of data to inform student FBAs. Direct observation data were gathered on trainees' procedural fidelity for the assessments conducted.
Results:
Data from the first year of training on preference assessment reflected marked improvements in trainee knowledge and confidence in their skills, along with increased procedural fidelity. Average trainee scores on the preference assessment knowledge exam improved by 53.2 percentage points at follow-up. Average self-rating scores for preference assessments improved by 83.3 percentage points from pre-workshop to follow-up and average procedural fidelity scores increased 9.5 percentage points approximately two months after the initial training day. Initial data from the second year of training on descriptive behavior assessments indicate that average trainees' exam scores on FBA and descriptive assessments improved by 9 percent from pre-workshop to post remote-training. Post training data will be included in the presentation, upon completion of the training on descriptive behavior assessments.
Conclusions:
Given that many educators are tasked with completing FBAs, but often lack the specialized training to effectively do so, this study has many practical implications. Training in this area may result in increased efficiency of the assessment process and the ability to conduct data-based FBAs by district personnel rather than the often expensive and lengthy process of utilizing outside consultants. Ultimately, the goal from this research is to increase the effectiveness of behavior intervention plans utilized for students with ASD that are developed as a result of these assessments.

276 **181.276** Understanding Intolerance of Uncertainty for Autistic Adults: Development of the Adult Coping with Uncertainty in Everyday Situations© Programme

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Background: Â Anxiety is a common co-occurring condition in adults with ASD. Difficulty tolerating uncertainty is a major contributor to the development and maintenance of anxiety. Our work indicates that Intolerance of Uncertainty (IU) is a key construct in anxiety in ASD that might contribute to the development and maintenance of a range of anxiety subtypes. We recently developed a parent based group intervention (CUES: Coping with Uncertainty in Everyday Situations), aimed at providing parents of young people with ASD with effective strategies to reduce their child's IU. Our development project demonstrated that the intervention was acceptable and feasible to families. No such programme exists to address IU in autistic adults. The aim of this study was initially to understand the experience of uncertainty on a day-to-day basis and identify suitable outcome measures so that we can then adapt and evaluate our intervention programme to make it suitable for use, on an individual basis with autistic adults experiencing IU.
Objectives: To develop and provide evidence of daily measurement of personally salient uncertain situations among autistic adults, in order to understand their experiences of IU and identify and capture suitable targets for treatment.
Methods: A multiple baseline observational single case design was used to identify and track personally salient uncertain situations with 4 autistic adults on a day-to-day basis, over a ten week period. Participants were aged over 18 years, with a diagnosis of ASD, with intellectual ability in the average range. Electronic daily diaries provided individualized self-monitoring of personally relevant symptoms, behaviours and engagement in target uncertain situations. Participants would then receive eight, one hour weekly IU treatment sessions with a qualified CBT therapist. Daily diaries are used throughout to provide individualized self-monitoring of personally relevant symptoms, target behaviours and engagement in target situations.
Results: All four adults identified a personally salient target uncertain situation that impacted on daily functioning. Situations identified included uncertainty related to social situations (x2), uncertainty related to work/professional demands (x2). Participants were able to actively engage in daily self-monitoring of their target uncertain situation and report on a range of symptoms and behaviours (negative affect, avoidance, confidence) associated with the situation. Stable baselines were achieved for all participants within two to three weeks of onset of self-monitoring; the daily diaries were then completed throughout the eight week intervention phase. Changes in self-monitoring of individualised target behaviours during the treatment phase will be reported.
Conclusions:
Our study is the first to explore the impact of intolerance of uncertainty on daily functioning for autistic adults. The single case observational design provides evidence that autistic adults are able to identify uncertain stations that have an impact on daily life. Furthermore, our data indicate that autistic adults find daily self -monitoring of the symptoms and behaviours associated with these situations to be feasible and acceptable. The results provide evidence of the feasibility of self-monitoring diaries as a method of capturing personally salient and meaningful data for use in intervention programmes targeting intolerance of uncertainty for autistic adults.

277 **181.277** Video Self-Modeling (VSM) As an Intervention for Adolescents with Autism Spectrum Disorders (ASD) in School and Clinical Settings

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Background: Â Video modeling refers to an individual viewing a video demonstrating a target behavior to learn to produce that same modeled behavior. Bandura' social learning theory suggests that new patterns of behavior can be learned through observation. In addition, this learning is strongest when the model is as similar as possible to the true behavior that one is attempting to change (Bandura, 1977). Video self-modeling (VSM) is a form of video modeling that enables the individual to perform the modeled behavior by watching him or herself perform the behavior effectively (Bellini & Peters, 2008). Bellini and Akullian's meta-analysis (2007) showed evidence that VSM is an effective intervention strategy for increasing positive social and communication, behavioral, and functional skills in children and adolescents with ASD. Further research suggests that VSM can generalize across multiple settings and that the learned skills throughout this process may be sustained for months after the intervention (Shukla-Mehta, Miller, & Callahan, 2010).
Objectives: Â Two research studies investigating VSM were completed. The objective of these studies was to determine the effectiveness of VSM in improving academic and conversational skills across school and clinical settings in adolescents with ASD. To the author's knowledge, these were the first studies to target these behaviors in adolescents with ASD.
Methods: Â A multiple baseline single-case design was used in both studies. VSM was implemented by recording videos, editing them, and showing them to the participants on iPads. Videos used were 1 to 3 minutes in length. Data collection was completed by more than one observer to determine inter-observer agreement. In Study 1, positive homework materials management behaviors were targeted in a general education classroom setting.Â In Study 2, conversational and pragmatic language skills were targeted in a clinical outpatient therapy setting.
Results: In Study 1, visual analysis and nonparametric effect size results suggested that the introduction of the VSM intervention was effective in improving compliance with classroom procedures related to homework in students with ASD and other neurodevelopmental and acquired disorders. Social validity data from the students and teachers involved in the project showed that the process was viewed as positive and realistic to implement in the classroom.
In Study 2, visual analysis and nonparametric effect size results suggested that the introduction of the VSM intervention in combination with social skills training was effective in improving conversational skills in 2 out of 3 adolescents with ASD. Social validity data from the parents and adolescents involved showed a positive response to the integration of VSM into the social skills training intervention.
Conclusions: Adolescents with ASD present educators and practitioners with several unique challenges. As social and academic environments becomes more multifaceted, the complexity of teaching individuals with ASD how best to navigate their world does as well. Ubiquitous access to iPad and other tablet technology suggests that video-based interventions are currently under-utilized. Clinicians and educators working with adolescents with a myriad of behavioral and academic challenges may consider ways in which a VSM intervention may be implemented into their practice.

278 **181.278** Who Benefits from Cognitive Training with Neurotracker?: Training Attention in Students with Autism Spectrum Disorder and Other Neurodevelopmental Disorders

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Background: Cognitive remediation involves targeting specific processes to reduce cognitive deficits, such as attention-related difficulties (Sonuga-Barke et al., 2014). For example, training attention is achieved by repeated practice on tasks that can best isolate attention (Willis & Schaie, 2009). A previous school-based study found that training with a multiple object tracking paradigm (*NeuroTracker*) improved performance on a separate, clinically validated measure of attention, for students diagnosed with a neurodevelopmental disorder (Tullo, Guy, Faubert, & Bertone, 2016). With Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), and Intellectual Disability exhibiting different profiles of attention (Antshel et al., 2013), an examination of which clinical profile benefits most from visuo-attentive *NeuroTracker* training can provide additional information to tailor cognitive remediation programs from a needs-based perspective.
Objectives: We assessed the efficacy of an attention training program using the *NeuroTracker* task, an adapted three-dimensional multiple object tracking paradigm found to be accessible to children and adolescents diagnosed with ASD or another neurodevelopmental disorder. Furthermore, we explored the effect of training to assess differences regarding improvements after *NeuroTracker* training for students diagnosed with ASD compared to those diagnosed with other neurodevelopmental disorders.
Methods: One hundred and twenty-nine students were included in the study (M_{age} = 13.24). All participants had a primary diagnosis of either ASD (n = 43), or any other neurodevelopmental disorder (n = 86; i.e., ADHD, Intellectual Disorder, genetic-based syndromes). A pre-assessment measure of attention was obtained for all participants via the Conners Continuous Performance Task (CPT-3) and then all participants were equally and randomly into; the experimental *NeuroTracker* training group (n = 43, n_{ASD} = 16), active control group (n = 43, n_{ASD} = 9) playing a strategy-math game: *2048*, or treatment as usual group (n = 43, n_{ASD} = 25). Both experimental and active control groups trained on their respective tasks every other day for a total of 15 training sessions. Post-training performance on the CPT-3 was compared to initial CPT-3 performance to detect an improvement in attention.
Results: Collectively, pre-assessment scores on the CPT-3 revealed that all students had deficits in attention. Results from the training results showed a significant difference in the change in CPT-3 that was specific to the experimental, *NeuroTracker* group. Training by diagnostic group revealed that *NeuroTracker* performance doubled from the first to the last (fifteenth) training session for both the ASD and non-ASD groups. Furthermore, there was no significant difference between change in CPT-3 scores after training with *NeuroTracker* between the ASD and non-ASD groups. This demonstrates that all participants in the experimental group benefitted equally from training with *NeuroTracker*, regardless of their clinical profile.
Conclusions: Our findings demonstrate that attention can be improved for students with ASD using the non-verbal, visuo-attentive *NeuroTracker* task. Furthermore, our findings demonstrate that training with *NeuroTracker* can benefit all students with problematic levels of attention, regardless of primary diagnosis. These results suggest that the *Neurotracker* training program is accessible and effective for children and adolescents with a neurodevelopmental condition that is independent of cognitive status and diagnostic profile.

279 **181.279** Worktopia: Perspectives of a Job Readiness Program for Individuals with Autism Spectrum Disorder

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Background: Employment opportunity for youth and adults living with Autism Spectrum Disorder (ASD) is unacceptably low. Without the opportunity to enter the work force individuals with ASD may be at greater risk for poverty and isolation. This issue calls for attention to developing capacity and improving opportunity for employment among persons with ASD. Worktopia is a new, nationally funded project in Canada designed to improve the employment futures of youth and young adults with ASD, ages 15 -29 as they transition from high school into independent living. Worktopia is an initiative that offers programs to enhance employment readiness at different ages and for varying levels of ability levels. Worktopia includes Employment Works Canada (EWC) and Community Works Canada (CWC). These programs are delivered by 13 different community agencies across 5 regions of Canada. These agencies are contracted to implement and evaluate these pre-employment training programs.
Objectives: To illuminate aspects of the EWC and CWC programs that promote work readiness; to identify program outcomes including benefits and barriers to participants and families.
Methods: Utilizing a grounded theory approach, qualitative interviews were conducted with a sample of participants with ASD and parents from both EWC and CWC programs across Canada. Findings from the interviews will be presented.
Results: Participants highlight the importance of continuity in relationships between support persons (e.g. program facilitators) and individuals with ASD. Key qualities of support included workers who built relational 'bridges', used humour, demonstrated respect, had previous experience with ASD, and were approachable. Parents also highlighted the importance of ongoing relational 'bridges'. Central teaching approaches embedded in adult learning principles such as structured learning, video modeling, and role play were found to enhance employment readiness. Challenges to program participation were transportation to the varied work sites and scheduling for persons with ASD in combination with their other life commitments (e.g. medical appointments). Successful outcomes included increased self-confidence, improved self-recognition, feeling part of the community and lowered fear of social interactions.
Conclusions: The experiences of participants and parents in the Worktopia employment program give direction for service providers and researches who are creating programs to enhance skills and increase work readiness for persons with ASD.

280 **181.280** "If You Make the Story Good Enough, It Becomes a Reward": Designing a Social Emotional Serious Game from the Perspectives of Youth on the Autism Spectrum and Professionals

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Background: While computer-based interventions (CBI) have shown promise in improving emotion recognition skills among people on the Autism spectrum, currently there is a need to improve the engagement and generalisation of skills to everyday environments. The Serious Game framework proposes five core design elements which potentially address the limitations of current CBI. It is likely that projects guided by this framework and inclusive of end-users in the development phase will be both more effective and engaging.
Objectives: Employing the Serious Game framework, this study aimed to identify the motivating features of a computer game targeting emotion recognition skills from the perspectives of youth on the Autism spectrum and professionals.
Methods: Four focus groups, three with youth on the Autism spectrum (n=11) and one with professionals experienced in social skills interventions (n=5) were conducted. Data was coded using directed content analysis and framed within the elements of the Serious Game framework of motivating storyline, goal-directed learning, rewards and feedback, progression in level of difficulty and individuation, and provision of choice. The perspectives of the youth on the Autism spectrum were taken as the central focus and were compared and contrasted against those of the professionals.
Results: Â Both groups suggested several features under the five main elements of the serious Game framework. The participants on the Autism spectrum favoured including social dilemmas with a gaming environment that was unpredictable and varied. The youth appreciated that a game provided them with the opportunity to experiment with situations that were potentially complex and overwhelming in real life. The professionals emphasised aspects of the game that supported the transfer of skills to real life contexts.
Conclusions: The youth and professional held differing views, with participants on the Autism spectrum stressing the importance of incorporating 'motivating' features in a story-based game and the professionals focusing mainly on the generalisation of skills to every day contexts. In combination the views of the two groups addressed the two main aims of the Serious Game framework of creating an engaging learning environment and promoting the transfer of skills to real life contexts. The contrasting perspectives of the youth and professionals highlights the importance of involving end-users in developing CBI. To date, CBI have focused on improving skills paying less attention to strategies aimed at motivating and engaging players on the Autism spectrum. Findings from this research suggest that CBI which focus on enhancing these aspects will be likely to experience lower dropout rates than those observed in current effectiveness studies.

281 **181.281** Examining Socialization Improvement Growth Trends of Adolescents Participating in an RCT of the Social Tools and Rules for Teens (START) Program for ASD: A Multi-Level Modeling Study

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Background: The interest in effective interventions to target the social vulnerabilities of adolescents with ASD has significantly increased in recent years (Miller et al, 2015). Such intervention efforts are not administered in a single therapeutic dose, but rather are conceptualized as operating through a series of interactions that, over time, aim to build self-sustaining interpersonal capabilities and alter the social trajectory of participating individuals. In recent years, researchers have become increasingly focused on the accumulating effects of an intervention on the unfolding behaviors and skills of a treatment recipient over time (e.g. Lerner et al, 2011). Such knowledge is crucial for further developing promising interventions, as it informs the relationship between dosage, time, accumulating therapy exposure, and eventual outcome. When data is serially collected at multiple time points along the course of an intervention timeline, valuable information about social growth trajectories can be gathered and analyzed.
Objectives: This investigation evaluated the effectiveness of the Social Tools And Rules for Teens (START) intervention program for adolescents with ASD using (a) serial data collection and (b) multilevel modeling to thoroughly understand the intercept and slope of social improvement data.
Methods: The participants of the project were 35 adolescents with ASD. All participants were randomly assigned to (a) the START program group or (b) a waitlist group for 20 weeks. The START program is a motivation-based curriculum that combines experiential and didactic elements into a comprehensive intervention package that includes high school peer models, individualized and group social targets, and self-management of selected skills. Participants assigned to the START condition participated in a weekly two-hour session consisting of: individual check-in sessions, free socialization periods, social activities, videos, social topic discussion and practice, and checkout sessions with parents. Dependent measures included parent and adolescent survey measures (Social Skills Improvement System, Social Responsiveness Scale - 2, Social Competence & Motivation Scale) and regular social conversation probes collected repeatedly at 5-week intervals. Multilevel modeling was used to analyze social competence change both within and between individuals. Unconditional, time-only, and full HLM models were specified.
Results: In the full HLM model, Time alone produced a significant slope effect on the adolescent SSIS scores ($p < .05$) and parent SCMS scores ($p < 0.1$). Treatment Group (i.e. START program participation) created a significant slope effect on adolescent SSIS scores ($p < .05$), SRS scores ($p < .01$), and both parent ($p < .001$) and adolescent ($p < 0.5$) SCMS scores, providing evidence of significant therapeutic gains unique to START program participation.
Conclusions: The full HLM model provides strong evidence that START participants experience markedly improved social growth trends when compared to waitlist controls. Specifically, significant positive trends in social skill (SSIS) and social competence/motivation (SCMS) were noted, along with reductions in ASD-related social impairments (SRS-2). This investigation is one of the first social skills studies to use MLM techniques to model robust changes on multiple measures of social competence. Overall, this study presents promising findings regarding the efficacy of an experiential social intervention for adolescents with ASD.

282 **181.282** The Use of Recommended Practices for Children with ASD in Urban Preschools

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Background: University-based treatment studies find substantial gains when intervention is provided to preschoolers with ASD, however children receiving intervention in the community on average make small gains. Evidence-based practices (EBPs) developed in university settings may not be available in community settings, or result in the same types of gains when delivered outside highly-controlled settings. Studying intervention as it is delivered as part of the public education system can provide important insights into which EBPs are in use in different types of preschool settings, and which recommended practices have the potential to be most effective, given the resources available.
Objectives:
To examine the use of recommended practices for children with ASD in different types of urban preschool settings and the association of EBP use with child outcomes.
Methods:
Participants are part of longitudinal observational study of community based interventions for preschoolers with ASD, data collection is ongoing. Implementation of EBPs for children with ASD were evaluated using the Educational Program Review (EPR) in three different school-based educational environments: ASD-only, Mixed disability, and Inclusion. For this measure, skill indicators of Teaming, Classroom Structure, Classroom Environment, Curriculum and Instruction, Social/Peer Relationships, Challenging Behaviors Management, and Building a Positive Instructional Climate are rated from "Minimal/No implementation" to "Full implementation" based on direct classroom observation and a teacher interview. Children's cognitive and language development were assessed 9 months apart (Mullen Scales of Early Learning; MSEL), and parents and teachers completed a questionnaire assessing adaptive behaviors (Adaptive Behavior Assessment System-2ndEd; ABAS). Multiple linear regression analyses controlling for child demographic characteristics were conducted to examine the association between EPR domain scores on developmental (MSEL) and adaptive behavior (ABAS) change scores.
Results:
Based on the preliminary results from 68 preschoolers (Mean age = 45.9 months, *SD* = 7.3, 77.9% Male, 45.6% Black/African American), the use of recommended practices significantly differed across ASD-only (n = 21), Mixed disability (n = 22), and Inclusion (n = 25) settings. ASD-only classrooms scored significantly better on teaming and classroom structure than the other types of classrooms, and on better classroom environment, curriculum, and challenging behaviors management than inclusion ($ps <$ .05). Inclusion classrooms provided better support of social/peer relationships ($ps < .001$). Mixed disability classrooms had better teaming and curriculum than inclusion ($ps <$ .01). The classroom types did not statistically significantly differ in their instructional climate.
In an adjusted analysis, better implementation of recommended practices for social/peer relationships was significantly associated with developmental gains ($b = 3.9$, $t(63) = 2.28$, $p = .03$). EBP use was not significantly associated with changes in adaptive behavior.
Conclusions:
These preliminary results suggest the programming available in ASD-only classroom settings is more closely aligned with recommended practices for preschoolers with ASD, than that available in less restrictive educational placements. However, implementation of EBPs related to supporting social/peer relationships (including opportunities to interact with typically developing peers), which was less available in ASD-only preschools, is an important predictor of developmental gains in urban preschools.

283 **181.283** Implementation Fidelity and Outcomes in School-Based Interventions

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Background: Most children with autism in the United States receive the bulk of their treatment through publicly-funded schools. However, most evidence-based practices (EBPs) for children with autism were developed and tested in highly controlled laboratory settings, with very high rates of intervention fidelity. Interventions delivered in the community often are delivered with much lower fidelity. While there is general consensus that intervention fidelity is associated with student outcome, there is little research examining this association in community settings.
Objectives: Using data from a large randomized field trial in an urban public school district of several EBPs for elementary school-age children with autism, we will: 1) evaluate teachers' mean and variation in treatment fidelity; 2) estimate the association between treatment fidelity and child outcomes; and 3) determine factors associated with treatment fidelity.
Methods: Direct observation fidelity measures were used to assess implementation fidelity to three EBPs (discrete trial training (DT), pivotal response training (PRT), and visual schedules (VS)) bi-monthly in 73 classrooms for an academic year (n = 73 teachers and 126 children). Implementation fidelity was measured along three dimensions: intensity (how often the teacher delivered the intervention), accuracy (whether the intervention was delivered as described in the manual), and a composite fidelity score that comprised the product of intensity and accuracy. Child outcome was measured as change in cognitive ability using the Differential Abilities Scales, 2nd edition (DAS-II) and overall performance on the Bracken Basic Concepts Scales. Differences in child outcome were estimated using linear regression models with random effects for classroom. Separate models were used where the independent variables of interest in turn included intervention intensity, accuracy, and the composite fidelity score. Qualitative interviews were conducted with a sample of the teachers to identify barriers and facilitators to treatment fidelity.
Results: Data are collected. Analyses are ongoing. Teachers' fidelity to all three EBPs on a scale ranging from 0-4 was low and varied substantially across teachers (DT accuracy- Mean: 2.3, SD: 1.3; PRT accuracy- Mean: 2.0, SD: 1.3; VS accuracy- Mean: 1.6, SD: 1.2). There was substantial variation in child outcomes for both the DAS (Mean change: 4.0, SD: 7.8) and the Bracken (Receptive Mean Change: 16.4, SD: 22.4; Expressive Mean Change: 11.5, SD: 10.2). The associations of fidelity to each of the intervention components and child outcome, as well as factors associated with treatment fidelity, are being estimated now.
Conclusions: Implementation fidelity to EBPs in public schools is significantly lower than that observed in university-based research settings, and varies substantially across teachers. Many challenges exist to implementing EBPs in public schools including limited resources, training and highly complicated interventions. Strategies to improve the implementation of EBPs in public schools are urgently needed in order to improve access to high quality care and will be discussed. Additionally, students demonstrated higher gains on a measure of overall academic performance than in cognitive ability; academic measures may offer a more sensitive alternative, especially for school-age children, to measures of cognitive ability traditionally used in autism treatment trials.

284 **181.284** Context Matters: A Mixed Methods Study of Organizational Factors That Affect Implementation of Interventions for Children with Autism in Public Schools

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Background: The significant lifelong impairments associated with autism spectrum disorder (ASD), combined with the growing number of children diagnosed with ASD, have created urgency in improving school-based quality of care. Although many interventions have shown efficacy in university-based research, few have been effectively implemented and sustained in schools, the primary setting in which children with ASD receive services. Organizational factors such as culture and climate have been shown to predict the implementation of evidence-based interventions (EBIs) for the prevention and treatment of other mental disorders in schools, and may be potential targets to improve implementation of autism EBIs in schools.
Objectives: The purpose of this study was to examine the organizational factors associated with the implementation of EBIs (i.e., discrete trial training, pivotal response training, and visual schedules) for children with ASD in public schools.
Methods: We applied the Domitrovich and colleagues (2008) framework of organizational and other contextual factors (e.g., leadership, implementation climate) that influence intervention implementation in schools. We quantitatively tested whether these factors (organizational culture and climate) were associated with the implementation of autism EBIs. Participants included 37 principals, 50 teachers and 75 classroom staff from 37 under-resourced public schools. We used qualitative methods (semi-structured interviews) to more comprehensively understand the strategies used to achieve successful implementation and sustainment of these interventions (26 principals and 28 teachers from the highest- and lowest-performing classrooms based on their fidelity data). Qualitative data will be analyzed using an integrated approach to conduct a detailed exploration of the intervention-setting fit, and observe similarities and differences in organizational-level factors among high and low performing classrooms. Independent observers rated implementation fidelity (i.e., adherence, dose, and competence) using a fidelity checklist. Participants completed ratings of organizational culture (behavioral expectations that members of an organization are required to meet in their work environment) and climate (individual employees' perceptions of the psychological impact of their work environment on their own function and well-being) using the Organizational Social Context measure.
Results: Data cleaning and coding are underway. Preliminary descriptive analyses indicate that the organizational culture and organizational climate were within average norms. A linear regression with random effects for classroom and school (to account for classrooms nested within schools) will be conducted to estimate individual associations between each organizational-level factor (i.e., organizational culture and climate) and key components of intervention fidelity (adherence, dose, and competence).
Conclusions: The results of this study will provide an in-depth understanding of organizational-level factors that influence the successful implementation of EBIs for children with ASD in under resourced public schools. These data will inform potential implementation targets and tailoring of strategies that will help schools overcome barriers to implementation and ultimately improve the services and outcomes for children with ASD.

285 **181.285** Statewide Interagency Collaboration to Increase Access to Professional Training in Evidence-Based Practice

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Background:
Most programs have very limited capacity for scaling up interventions in ways that lead to meaningful improvements in outcomes for individuals with ASD, and collaboration across service systems presents even greater challenges.
The California Autism Professional Training and Information Network (CAPTAIN) is a statewide collaboration of providers from Special Education Local Plan Areas, Regional Centers and Family Resource Centers with the common goal of providing training and technical assistance in evidence-based practices (EBPs) for ASD. CAPTAIN was established in 2012 and currently has over 400 members who were nominated to participate by their employing agency. Members are expected to provide training in EBPs for ASD to providers within their home agency.
A leadership team of cross agency representatives guides the training and support efforts of the organization, including coordinating an annual 2-day training summit for members, maintaining a website and providing a 10hr on-line course on ASD.
Objectives:
The current project will characterize CAPTAIN participation statewide during the 2015/2016 fiscal year and will describe training practices used by CAPTAIN members and identified barriers to training in EBPs for ASD.
Methods:
Administrative data were analyzed to determine agency engagement in CAPTAIN. A 56 item survey was distributed to CAPTAIN cadre members to gather descriptive data on training practices and barriers to implementation of training in EBPs for ASD.
Results:
Three hundred seventy-one CAPTAIN cadre members participated. Member nomination and CAPTAIN endorsement across state agencies was high with 87% of SELPAS, 90% of Regional Centers and 100% of Family Resource Centers participating. Within the group, the majority of cadre members were representing SELPAs (n=303; 82%), then Regional Centers (n=53; 14%) and Family Resource Centers (n=15; 4%).
Preliminary analysis of survey data indicates successful outcomes in terms of the frequency of training offered by cadre members, with 86% of SELPA cadre members conducting some training on EBPs for ASD. Approximately 20% of cadre members reported doing some type of training in EBP (group or 1:1) on a weekly basis, 32% conducted training at least monthly. Of those conducting training, 84% indicated they used live demonstrations, role playing and practice. Seventy percent of cadre members reporting using a fidelity checklist when coaching trainees. Additionally, 75% report collecting data on student outcomes to ensure the EBP is having the desired effect.
Adequate time for training and coaching was identified as a primary barrier to implementation of training in EBP by a majority of cadre members (56%); however other primary barriers were identified by lower percentages of cadre members, including administrative support (6.9%), trainee/staff support (13.8%), knowledge (3.2%), policy (.5%), -organizational issues/turnover (7.4%).
Conclusions:
These data indicate preliminary success for CAPTAIN and the inter-agency collaboration process of disseminating information about EBP for ASD statewide. However, data also indicate variability in the amount of training and types of training provided state-wide. Data collected on barriers and facilitators of implementation of EBP training indicate time as a primary barrier to providing training. Additional analyses are on-going and will be discussed.

Poster Session
182 - Miscellaneous
12:00 PM - 1:40 PM - Golden Gate Ballroom

286 **182.286** Memory in Autism: A Case of Remembering Versus Knowing

S. V. Huemer[1]*, F. Kruggel*[2]*, V. Mann*[2] *and J. Gehricke*[3]*, (1)University of CA - Irvine, Rancho Palos Verdes, CA, (2)University of California Irvine, Irvine, CA, (3)University of California, Irvine, Santa Ana, CA*

Background:
Tulving (1983) divides human memory into two distinct systems that are open to conscious awareness: The semantic system stores timeless facts available mostly upon cued recall recognition, while the episodic system relies on an individual's ability to put stored memories into a spatio-temporal and self-referential context upon free recall (Tulving, 2002). The Remember/Know (R/K) procedure (Tulving, 1985) is used in recognition tasks to study both memory systems. Zelazo and Frye (2001) have shown that children with ASD have problems with episodic remembering. Episodic recognition involving the recollection of contextual information (R) is mediated by hippocampal processes while familiarity based recognition (K), which is intact in ASD, is mediated by perirhinal processes (Brown & Aggleton, 2001).Â Morphological abnormalities of the hippocampus are well documented in ASD (Groen et al., 2010; seeÂ Nicolson et al., 2006).
Objectives:
Our study was interested in finding out how adolescents with ASD process their own first name as opposed to other names. We planned to compare their results to those of neurotypical peers. We predicted that control subjects would activate areas of self-reference and episodic memory, such as the left tempo-parietal cortex, the superior temporal gyrus, and the hippocampus when hearing their own name. Subjects with ASD, on the other hand, were expected to employ compensatory processes including the perirhinal regions when hearing their own name.
Methods:
In this preliminary functional magnetic resonance imaging (fMRI) investigation, we compared brain activity of 9 adolescents with ASD with those of 9 neurotypical adolescents to four categories of auditory language stimuli: their own first name (SFN), familiar people's names (OFN), names of objects of high interest (OBJ), and numbers (NUM). Each participant listened passively to the randomly sequenced names during three sessions. Each session contained the subject's name five times and five different names from each of the other categories. We also administered a test of verbal receptive ability to test whether our results may align with scores on the test.
Results:
When hearing their own names, controls and subjects with ASD who scored high on the verbal ability test activated regions in the insula, superior temporal gyrus as well as the hippocampus, brain regions associated with self-referential processing and long term memory, or, R (remembering). In contrast, subject with ASD who scored low on our test of receptive verbal ability lower-scoring subjects showed activity in the prefrontal cortex and the thalamus, regions associated with new learning and K (knowing).
Conclusions:
Our findings support prior research on episodic memory processing differences in ASD. They also suggest that ASD subjects with lower verbal ability recognize, or, "know" their own name like a newly acquired fact rather than "remember" their name in a self-referential and spatio-temporal context. We also found that the results of controls and ASD subjects with higher verbal ability were more like each other than the results of the higher and the lower scoring ASD groups, which indicates that memory function in ASD aligns with verbal ability. Future studies have to explore these findings with larger samples.

Oral Session - 11A
183 - Mental and Physical Health in Adulthood
1:15 PM - 2:05 PM - Yerba Buena 3-6

Session Moderator: Laura Klinger, *UNC TEACCH Autism Program, Chapel Hill, NC*

1:15 **183.001** Autism and Depression in Young Adulthood: Cohort Studies in Sweden and England

D. Rai[1,2], *I. Culpin*[1], *R. M. Pearson*[1], *C. Dalman*[3], *H. Heuvelman*[1], *M. Lundberg*[3], *P. Carpenter*[2], *J. Golding*[1] *and C. Magnusson*[3], *(1)School of Social and Community Medicine, University of Bristol, Bristol, United Kingdom, (2)BASS Autism Services for Adults, Avon & Wiltshire Partnership NHS Trust, Bristol, United Kingdom, (3)Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden*

Background: Depression is considered one of the most common comorbidities in autism, but longitudinal studies following children through early adulthood are scarce. Genetic links between autism and depression have been suggested, but environmental factors such as bullying may be important modifiable intermediaries, but have not been adequately investigated.
Objectives: 1) To use two large population based cohorts with complementary strengths to assess the association between childhood autism spectrum disorders and autistic traits and adult depression. 2) To assess the risk of depression in non autistic siblings. 3) To assess whether bullying in adolescence mediates the relationship between autistic traits and adult depression.
Methods: In the Stockholm Youth Cohort, we assessed the risk of a depression diagnosis in young adulthood (age 18 to 27 years) in children with autism as compared to the general population, and their non autistic siblings. In the Avon Longitudinal Study of Parents and Children (ALSPAC), we studied the trajectory of depressive symptoms (measured by the Moods and Feelings Questionnaire), and relative risks for depression at age 18 years (measured by the Clinical Interview Schedule-Revised) in relation to four dichotomised autistic trait measures known to optimally predict an autism diagnosis in ALSPAC: the Children's Communication Checklist (coherence subscale), the Social and Communication Disorders Checklist, a repetitive behaviour measure, and the Emotionality, Activity and Sociability scale (sociability subscale). We used structural equation models to estimate the mediating effect of bullying in adolescence in the association between autistic traits and depression at age 18 years.
Results: A diagnosis of autism was strongly associated with a diagnosis of depression in young adulthood [adjusted RR 3.7 (95% CI 3.5-3.9)] in the Stockholm Youth Cohort. Individuals with autism were over two fold more likely to have a diagnosis of depression in young adulthood when directly compared to their non autistic siblings [adjusted OR 2.6 (1.9-3.5)], who were themselves at a higher risk of depression than the general population. In ALSPAC, children with all trait measures of autism had higher rates of depressive symptoms at age 10, but the social communication trait had the strongest association with a depression diagnosis at age 18 (adjusted RR 1.56 (1.02 to 2.40), p=0.041]. Bullying in adolescence accounted for 42% of the total estimated association between low social cognition and depression at age18 years in ALSPAC.
Conclusions: Taken together, the findings suggest that children with autism are at a higher risk of depression in young adulthood than the general population, and that social communication impairments may be the key autistic feature in relation to adult depression. Despite the potential role of a genetic predisposition to depression, the substantial role of bullying as a potentially mediating mechanism suggests that this may be a target for intervention and preventative action against depression in young people with autism.

1:27 **183.002** Increased Risk for Self-Harm in Autism: Preliminary Findings from the Stockholm Youth Cohort

I. Bubak[1], *D. Rai*[2], *S. Idring Nordstrom*[3], *M. Lundberg*[4], *I. Culpin*[2], *C. Dalman*[4] *and C. Magnusson*[4], *(1)Department of Public Health, Stockholm County Council and Karolinska Institutet, Stockholm, Sweden, (2)School of Social and Community Medicine, University of Bristol, Bristol, United Kingdom, (3)Department of Public Health Sciences, Stockholm, SWEDEN, (4)Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden*

Background:
Recent evidence suggests that mortality from suicide is increased in autism spectrum disorder (ASD), and particularly in ASD without intellectual disability (ID). Self-harm i.e. self-poisoning or self-injury irrespective of suicidal intent, is the strongest known predictor for subsequent suicide. Self-harm is, however, poorly studied in ASD including whether there are patterns in self-harm methods of prognostic relevance for suicide. In addition, little is known about how co-morbid conditions such as ID and Attention Deficit Hyperactivity Disorder (ADHD) affect risk of self-harm.
Objectives:
To determine the relationship between ASD and self-harm in a large total population study. To investigate risk and protective factors for self-harm in ASD, with emphasis on co-morbid ID and ADHD.
Methods:
We conducted a total population study using the Stockholm Youth Cohort (N=696,612). Prospectively recorded data for probands followed-up from 0 to a maximum of 27 years by 2011, and their first and second-degree relatives, was collected through record linkage. A total of 11,663 individuals with ASD were identified. Hospital admissions with discharge diagnoses ICD-10 X60-X84 and Y10-Y34 denoted self-harm. We used multivariable Cox proportional hazards regression models to estimate hazard ratios (HRs) with 95% confidence intervals (CIs) of self-harm, overall and categorized as self-harm by poisoning, self-cutting and severe self-harm (including hanging, strangulation, firearm, drowning, jumping from high place/in front of moving objects).
Results:
A diagnosis of ASD was strongly associated with risk of hospital admission for any self-harm
(adjusted HR 4.5, 95% CI 3.8-5.4), self-poisoning (aHR 4.6, 95% CI 3.7-5.6), self-cutting (aHR 5.6 95% CI 3.8-8.3)
and severe self-harm (aHR 5.7, 95% CI 2.5-13.0). This risk increase was even further marked for ASD with co-morbid ADHD for any self-harm (aHR 8.5, 95% CI 7.0-10.3), self-poisoning (aHR 7.6 95% CI 6.2-9.2), self-cutting (aHR 9.6 95%CI 6.6-13.9) and severe self-harm (aHR 16.1 95% CI 8.6-30.4). In contrast, ASD with ID was not associated with hospital presentations for self-harm.
Conclusions:
These preliminary findings indicate that individuals with ASD have an elevated risk for engaging in self-harm in adolescence and young adulthood, and particularly in severe self-harm. Co-occurring ADHD appears to aggravate this risk, which suggests that identification and treatment of ADHD in ASD may be important for suicide prevention. Co-occurring ID, on the other hand, appears protective. Overall, patients with ASD should be considered a risk group for self-injurious behavior and should be given special attention in clinical settings.

1:39 **183.003** The Relationship Between Mental Health, Employment and Quality of Life: Findings from the Autism Spectrum Cohort-UK

A. Petrou[1], *H. McConachie*[2], *A. Le Couteur*[2], *B. Ingham*[3], *J. Hamilton*[3], *T. Berney*[1], *D. Mason*[2], *D. Garland*[4] *and J. Parr*[1], *(1)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom, (2)Institute of Health and Society, Newcastle University, Newcastle upon Tyne, United Kingdom, (3)Northumberland, Tyne and Wear NHS Foundation Trust, Newcastle Upon Tyne, United Kingdom, (4)National Autistic Society, Newcastle upon Tyne, United Kingdom*

Background:
Autism is a lifelong neurodevelopmental condition usually diagnosed during child or adulthood, and rarely during older age. Most autism research has been undertaken with children and young people. Much less is known about the course of autism through the many transitions across the lifespan. There is a lack of evidence about effective interventions and little research knowledge regarding the impact of ageing for autistic adults. Very little research has been undertaken to investigate the mental health and personal needs of adults on the autism spectrum.
Objectives:
To examine the prevalence of mental health/neurological conditions of autistic adults, their association with employment status and whether this is mediated by quality of life.
Methods:
Participants are autistic adults, and relatives/carers acting as 'consultees' for adults lacking capacity to consent for themselves to research participation who are part of the Autism Spectrum Cohort–UK (ASC-UK), a longitudinal research project aiming to investigate the life experiences of adults on the autism spectrum. Autistic adults were recruited through health teams, voluntary sector organisations, and the autism community. They completed questions on any current mental/neurological health diagnoses, and employment status. By July 2016, 576 adults had consented to join ASC-UK (males=319, females=245, other gender=12; range=17-86 years; mean age=39.6 years). This included participants across the following age bands: 16-25 years=123, 26-40 years=192, 41-60 years=217, 61+ years=44. 367 autistic adults also completed the World Health Organisation Quality of Life–BREF (QoL).
Results:
Autistic adults reported high current rates of diagnosed depression (46.9%), anxiety (49.7%) and other mental health conditions. 71.9% reported that they had previously tried to access services, of whom 40.6% reported receiving the necessary services. Reasons for not accessing services included a lack of availability or referral routes into services.Â Having a mental health/neurological condition negatively predicted physical, psychological, social, and environmental QoL (β=-.194 to -.274; all p<.001) whereas being employed positively predicted physical QoL only (β=.118, p<.001). Autistic adults aged 41-60 years were more likely to report mental health/neurological diagnoses if they were unemployed compared to employed (Mann-Whitney U=2350.5, z=-4.2, p<.001). In this age group, employment status was related to mental health/neurological conditions (β=1.612, p<.01), and employment status was related to physical QoL (β=.320, p<.001). Physical QoL acted as a mediator between employment status and mental health/neurological conditions (β=-.414, p<.001) such that the relationship between employment status and mental/neurological health conditions was no longer significant (β=.921, p=.151).
Conclusions:
Mental health/neurological conditions are common in autistic adults who, despite trying to access services, have difficulty getting the services that they need. For autistic adults between 41-60 years of age, satisfaction with physical QoL issues such as access to health services, may mediate the relationship between employment status and mental health/neurological conditions. Since autistic adults do not have increased rates of accessing mental health services compared to the general population (Adult Psychiatric Morbidity Survey 2016), increased availability of mental health interventions may be helpful to prevent individuals dropping out of employment in their 40s and 50s.

1:51 **183.004** Health Outcomes of Adults with ASD

W. S. McKinney[1], *M. R. Klinger*[2], *P. S. Powell*[3] *and L. G. Klinger*[2], *(1)Northwestern University, Evanston, IL, (2)UNC TEACCH Autism Program, Chapel Hill, NC, (3)School of Psychology, Georgia Institute of Technology, Atlanta, GA*

Background: Little research has focused on the health outcomes of adults with ASD. The research that has been done has had either very high or very low rates of comorbid intellectual disabilities, as well as an oversampling of young adults (Croen et al., 2015; Fortuna et al., 2016). Additionally, because of the chart review design of these studies, the age, stability, and method of diagnosis was often unknown.
Objectives: The aim of this study was to characterize the health status of adults diagnosed with an ASD as children by providing descriptive data on prevalence rates for a wide variety of health conditions, as well as to compare these rates to nationwide norms for age-matched participants from the 2015 National Health Interview Survey (National Center for Health Statistics, 2015).
Methods: Caregivers of adults with ASD (N = 268; 213 males, 55 females) completed a survey on the adult's health status. The survey requested diagnostic information on 38 conditions. Adults with ASD (21-50 years; M = 34.99) were diagnosed during childhood between 1970 and 1999 through the UNC TEACCH Autism Program. Health prevalence rates were compared to an age-matched normative sample (N = 16,168; 21-50 years; M = 35.59).
Results: Adults with ASD reported significantly fewer cases of arthritis (ASD: 4%; US: 10%; p =.002), lower back pain (ASD: 4%; US: 27%; p < .001), migraines (ASD: 9%; US: 18%; p < .001), ulcers (ASD: 2%; US: 4%; p <.04), and cancer (ASD: 0.7%; US: 2.5%; p = .05) than the comparison sample. Additionally, adults with ASD reported significantly more cases of high cholesterol (ASD: 22%; US: 14%; p < .001), diabetes (ASD: 6%; US: 4%; p =.02), inflammatory bowel disease (ASD: 3%; US: 1%; p < .001), heart disease (ASD: 2%; US: 0.8%; p = .05), and epilepsy (ASD: 24%; US: 2%; p < .001). Comparable rates of obesity (ASD: 28%; US: 32%; p = .07), hypertension (ASD: 13%; US: 16%; p = .08), heart attacks (ASD: 0.4%; US: 0.5%; p = .50), and asthma (ASD: 10%; US: 13%; p = .11) were observed, although several results trended towards significance.
Conclusions: Similar to research by Croen et al. (2015), this study found significantly higher rates of many diagnoses including high cholesterol, diabetes, heart disease, inflammatory bowel disease, and epilepsy. Additionally, results found that diagnoses principally dependent on client self-report of pain experience (arthritis, lower back pain, migraines, and ulcers) occurred at significantly lower rates than in the normative sample. The unique social communication deficits present in ASD may prevent the proper reporting of pain experience leading to these lower rates of diagnosis. Future work should explore alternative ways of assessing pain for adults with ASD to examine whether adults with ASD genuinely experience fewer pain disorders or are underdiagnosed for these disorders. Additionally, more attention needs to be given to the increased cardiovascular and gastroenterology health risks seen in adults with ASD in order to further document this risk, investigate the source of risk, and develop treatments.

Oral Session - 11B
184 - ASD and Sexuality
2:10 PM - 3:00 PM - Yerba Buena 3-6

Session Moderator: Laura Klinger, *UNC TEACCH Autism Program, Chapel Hill, NC*

2:10 **184.001** Sexuality in ASD: The Female Profile

L. A. Pecora[1,2], *G. Hancock*[3], *G. Mesibov*[4] *and M. A. Stokes*[5], *(1)Deakin University, Parkdale, Australia, (2)School of Psychology, Deakin University, Burwood, Australia, (3)Deakin University, Werribee, Australia, (4)University of North Carolina at Chapel Hill, Chapel Hill, NC, (5)School of Psychology, Deakin University, Melbourne, Australia*

Background: Current understandings of sexual development and sexuality of females with High-Functioning Autism (HFA) are limited, and drawn only from few clinical anecdotes and qualitative case reports. Recent systematic reviews and meta-analyses suggest that females with HFA report poorer overall levels of sexual functioning and experience more sex-related problems and harassment than males with HFA and TD counterparts.
Objectives: The objective of this study was to quantitatively investigate sex differences in sexual development and sexuality in males and females with HFA, in order to confirm qualitative accounts that suggest poorer sexual and romantic functioning for females in this group.
Methods:
Participants consisted of 232 individuals with HFA (97 males; 134 Females; 1 unreported [*M* = 25 years]) and 227 non-clinical controls (66 males; 161 females [*M* = 27 years]). Demographic information, self-reported levels of personal wellbeing, and sexual and romantic functioning were assessed using the SBS-III a 236-item online questionnaire that measures a range of social, sexual and romantic domains across 14 subscales.
Results:
While controlling for age, analyses confirmed the hypotheses that females with HFA would report poorer levels of overall sexual and romantic functioning and adverse sexual experiences across a range of sexuality domains than males with HFA.
Males with HFA reported overall greater engagement in a range of sexual behaviours, and thus a greater level of sexual experiences than females with HFA $F(1, 209)=11.41$, $p<.001$, $=.05$. Females however, were found to be more subject to a range of negative and adverse sexual experiences than males with HFA, where they reported greater instances of being victims of unwanted sexual advances $F(1, 209)=25.84$, $p<.001$, $=.01$, and engagement in sexual behaviours with others that they either did not want to $F(1, 209)=15.95$, $p<.001$, $=.07$, or regretted doing so following the event $F(1, 209)=14.53$, $p<.001$, $=.07$.
While there were no significant differences in the level of engagement in sexual behaviours between females with HFA and TD females, females that met diagnosis reported less interest in sex and sexual behaviours $F(1, 283)=7.20$ $p<.01$, $=.03$, fewer reported experiences of any form of sexual attraction to another person $F(1, 283)=6.46$, $p<.05$, $=.02$, and greater instances of bullying or victimisation due to having less sexual knowledge and experiences than other same aged peers than TD females $F(1, 283)=8.82$, $p<.001$, $=.03$.
Analyses revealed that males with HFA reported greater instances of both casual romantic experiences (dating, courting) $F(1, 220)=6.05$, $p<.05$, $=.03$; and being previously or currently involved in a romantic relationship $F(1, 220)=8.26$, $p<.01$, $=.04$.
Conclusions:
The data confirm existing qualitative case reports that suggest females with HFA are subject to a range of adverse experiences in their pursuit of a healthy sexual development and sexual life. While results are preliminary, they warrant the importance of further investigation in order to identify the sex-specific challenges and concerns that are unique to females on the spectrum, and urgency in developing targeted sex education programs and services that meet the needs of this diagnostic group.

2:22 **184.002** Romantic Relationship Experience in Autism Spectrum Disorder

G. Hancock[1], *L. A. Pecora*[2], *G. Mesibov*[3] *and* ***M. A. Stokes***[4], *(1)Deakin University, Werribee, Australia, (2)Deakin University, Parkdale, Australia, (3)University of North Carolina at Chapel Hill, Chapel Hill, NC, (4)School of Psychology, Deakin University, Melbourne, Australia*

Background:
Socio-sexual functioning encompasses an individual's interests, behaviours, and understandings with respect to sexual, romantic, and social aspects of life. Previous systematic review and meta-analyses revealed differences in these areas, between typically developing (TD) individuals and individuals with ASD. It was further suggested that an individual's understanding of these domains is developed through both experiences and sex education. However, empirical evidence for the effect of ASD on romantic relationship experience is scant.
Objectives:
A proposed theoretical model predicted that individuals with ASD would report less romantic relationship experience than typically developing (TD) individuals. The aim of this study was to measure and explore this, assessing whether the relationship between ASD status (ASD or non-ASD) and romantic relationship experience, is mediated by peer engagement.
Methods:
An online questionnaire comprising of the Sexual Behaviour Scale – third edition (SBS-III), a measure of sexual functioning validated by item response analysis was completed by 232 individuals with ASD (mean age 25) and 227 individuals without ASD (mean age 22). A mediation analysis was undertaken to assess the indirect relationship between ASD status and romantic relationship experience, as mediated by peer engagement.
Results:
Compared to those without ASD, those with ASD did not differ to the degree that they were interested in being in a relationship (p = ns), however were found to have fewer relationship opportunities, $t_{(457)}=-1.76$, $p<.05$, $d=0.17$, and had relationships that lasted a briefer time, $t_{(321)}=-2.79$, $p<.01$, $d=0.31$. This is consistent with greater worry about not being able to build and maintain good relationships reported by individuals with ASD, compared those without such diagnosis, $t_{(434)}=4.71$, $p<.001$, $d=0.44$. Additionally, those without ASD had greater formal sex-education than those without, $t_{(458)}=2.33$, $p<.05$, $d=0.22$.
While controlling for age and gender, analyses confirmed the presence of an indirect effect between ASD and romantic relationship experience ($b=0.78$, 95%CI [.33, 1.40]). The effect remained evident even when not controlling for age and gender. This indicates that the relationship between ASD status and amount of romantic relationship experience, is mediated by the amount of peer engagement. Additional analyses suggested that gender was also a predictor of relationship total ($b=-3.29$, 95%CI [-1.49, -5.10]), with an increase in gender to female a person with ASD was likely to have had fewer relationships.
Conclusions:
It was found that the impact of an ASD diagnosis on one's ability to establish and maintain romantic relationships is mediated by the amount of engagement that they have with peers. This supports an important part of the proposed model, that is, that having less social peer engagement, along with receiving less sex education, leaves individuals with ASD at a double disadvantage from others, who are receiving this information from both of these avenues. For clinicians, these findings suggest that interventions and supports should be focused on improving the amount of social engagement, as this will also improve the individual's romantic relationship experiences. Such understanding and support is of particular importance given the central role of social and sexual wellbeing on one's quality of life.

2:34 **184.003** Sexuality in the Eyes of Parents and Young Adults with Autism Spectrum Disorder

K. Hartmann[1], *T. Kozikowski*[1], *T. V. Williams*[2], *M. Urbano*[1], *N. L. Kreiser*[3], *L. R. Qualls*[2] *and P. L. Alexander*[1], *(1)Eastern Virginia Medical School, Norfolk, VA, (2)Virginia Consortium Program in Clinical Psychology, Norfolk, VA, (3)Psychiatry and Behavioral Science, Eastern Virginia Medical School, Norfolk, VA*

Background: Â Sexuality is a difficult topic for most people given social rules, whether they are neurotypical or have additional challenges such as ASD. Especially as their child becomes sexually mature, families find themselves facing difficult issues to consider when communicating about sexuality. As many individuals with ASD rely on their family of origin well into their adulthood, this study examined young adults with ASD (YA) and their parents (P) perceptions about the YA's sexuality and sexual behaviors.
Objectives: This study explored YA and P perceptions about sexuality with a focus on sexual privacy, education, behavior, victimization and concerns. Our primary aim was to examine YA's desires for intimate relationships, behaviors towards a person of romantic interest, and sexual experiences. Our second aim was to explore YA and P agreement in their perceptions of YA's sexual experiences and behaviors.
Methods: Â YA and P were recruited largely from a metropolitan East Coast area. Data were collected in an anonymous on-line survey. 118 YA were matched to P responses. All participants completed a series of measures to characterize the YA participants and their sexual experiences including privacy, education and behavior on the Sexual Behavior Scale (SBS), negative experiences including victimization on the Sexual Experience Scale (SES), knowledge on the General Sexual Knowledge Questionnaire (GSKQ), and sexual orientation and contacts on the Klein Sexual Orientation Grid (KSOG)
Results: Â Descriptive statistics were calculated to examine YA's sexual behaviors and experiences. A significant proportion of YAs reported that they have had sexual intercourse (53.4%). However, many YA also indicated that they have never been romantically interested in another person (32.5%). Paired samples t-tests were used to assess discrepancies between P and YA reports on the above measures. Results showed a significant difference between YA and P report on the SBS privacy subscale, SBS sexual behavior subscale, and SES victimization subscale (Table 1). Notably, YAÂ reported more privacy seeking for masturbation than their parents reported (t (92) = -2.12, p = .037). P and YA also significantly aligned on several individual item responses (all Cohen's κ > 0.32, p < 0.001, % agreement > 82.9%; Figure 1).
Conclusions: A large proportion of YA reported having had sexual intercourse while many reported not being romantically interested in another person. YA and their parents agree on many questions about the YAs sexuality. Differences were found in YA's reports of more normal privacy and sexual behaviors than P reported. This may be due to YA perception of their behaviors as typical. It may also be due to parents remembering and reporting the YA's most salient inappropriate behaviors from an earlier developmental stage of the YA. YA reported higher experiences of sexual victimization than their parents reported for them suggesting a communication gap that warrants clinical intervention. Parent and YA overwhelmingly expressed their desire for assistance with sex education and this may be best addressed in the ASD population by improving family communication about sexuality.

2:46 **184.004** Falling in Love and Living Together? Sexual Attraction and Relationship Status in Adolescents and Adults with ASD.

J. Dewinter[1], *H. de Graaf*[2] *and S. Begeer*[3], *(1)Child and adolescent psychiatry, GGzE, Eindhoven, NETHERLANDS, (2)Rutgers, Utrecht, Netherlands, (3)VU University Amsterdam, Amsterdam, NETHERLANDS*

Background:
Sexuality is more and more accepted as a normative part of adolescent development and adult functioning, also in men and women with ASD. The majority of people with ASD without an intellectual impairment reports interest in having a relationship. Notwithstanding that ASD features are assumed to hamper relationship and sexuality development, recent research showed that a major part of people with ASD has experience with a romantic relationship, in contrast to earlier findings. Differences in these relationships compared to the general population remain assumed. Earlier publications suggested that more people with ASD also feel attracted towards people of the same sex or that younger heterosexual men with ASD are more likely to be single.
Objectives:
The aim of this study was to explore sexual attraction and relationship experience in adolescents and adults with ASD.
Methods:
Participants in the Netherlands Autism Register (n=675, 48.3% male, age 15-80) answered online single questions about their experienced gender, sexual attraction, relationship status and how they experienced this, and whether their partner had ASD. These findings are compared to data of a large sexual health study conducted in the Dutch general population.
Results:
About 30% of women with ASD and 10% of men reported some degree of gender non-conformity. Only half of the women with ASD felt only attraction towards men, and 80% of men with ASD towards women. Both experienced gender and sexual attraction were more diverse compared to the general population. About half of the men and women were in a romantic relationship, which is less than peers in the general population. Only a small minority was in a non-heterosexual relationship. Comparable numbers of people lived together with their partner. Of the men, 12% had a partner with (suspected) ASD, compared to a third of the women. Of those in a relationship, the majority evaluated their relationship as satisfactory. In the singles, 30% regretted their lack of a partner.
Conclusions:
In this study, a greater variety in gender experience and sexual attraction appeared in the adults with ASD compared to their peers in the general population, especially in women with ASD. About half of the adults with ASD without an intellectual disability reported to be in a romantic, mostly heterosexual, relationship and the majority of them lived together with their partner. The variety in attraction was not reflected in the number of non-heterosexual relationships. Research on the way people with ASD experience and define their gender and sexual attraction is necessary, for example in order to explore how people with ASD come to a self-definition and which factors influence this. Attention to gender- and attraction diversity in sexuality education and support to adolescents and adults with ASD is important.

Oral Session - 12A
185 - Evaluating Social Attention and Reward in Young Children with ASD
1:15 PM - 2:05 PM - Yerba Buena 7

Session Moderator: Bhismadev Chakrabarti, *School of Psychology and Clinical Language Sciences, University of Reading, Reading, United Kingdom*

1:15 **185.001** Initiating Joint Attention: Reduced Gaze Alternation in Infancy Is Related to More ASD Symptomatology in Toddlerhood

E. Thorup[1], *P. Nyström*[2], *G. Gredebäck*[2], *S. Bolte*[3] *and T. Falck-Ytter*[3,4], *(1)Uppsala universitet, Stockholm, SWEDEN, (2)Uppsala University, Uppsala, SWEDEN, (3)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Institutionen för kvinnors och barns hälsa (KBH), Karolinska Institutet, Stockholm, Sweden, (4)Dept of Psychology, Uppsala University, Uppsala, Sweden*

Background: Â Children with Autism Spectrum Disorder (ASD) are known to initiate Joint Attention (IJA) to a lesser extent than typically developing children. The incidence of higher level IJA behaviors, such as pointing, has been shown to discriminate between children at high vs. low risk (HR vs. LR) for ASD during the second year of life. It is less clear whether lower level IJA behaviors, such as the shifting of gaze between an interaction partner and an event occurring outside that person's field of vision, can discriminate between groups. If valid, the measure would have the advantage of allowing earlier assessment than high level IJA behaviors.
Objectives: The aim of the present study was to assess whether the number of gaze shifts made between a person and an event occurring outside his/her field of vision could discriminate between HR and LR infants at 10 months, and to evaluate possible associations with later autism symptomatology as well as with higher level IJA behaviors.
Â Methods: This face-to-face eye tracking study included a group of ten month old siblings of children with ASD (HR-group; N = 59) and a group of infant siblings of typically developing children (LR-group; N = 21). While the infant interacted with an adult experimenter, blinking lights appeared intermittently outside the experimenter's field of vision. The number of gaze shifts made by the infant between the experimenter and the lights was used as the dependent measure. At 18 months, the infants were assessed with the ADOS-T, and correlations with the primary measure were calculated.
Results: The LR-group made more gaze shifts between the experimenter's face and the lights at 10 months than did the HR-group, $p < .05$. This could not be explained by differences in the ability to disengage (assessed by a modified version of the AOSI disengagement task). Moreover, more alternating gaze behavior was associated with lower ADOS-T scores at 18 months in the HR-group, $r = -.29$, $p < .05$. Finally, making more gaze shifts at 10 months was associated with lower scores on the ADOS-T items showing, $r = -.30$, $p < .05$ and pointing, $r = -.33$, $p < .05$.
Conclusions: This study shows that alternating gaze behavior during face to face communication discriminates between infants at risk for ASD and controls, and that this measure relates to later ASD symptomatology in the HR group. These findings, together with the specific associations observed between alternating gaze and later pointing and showing behaviors, further validate alternating gaze behavior as a measure of IJA in infants. The measure has the advantage of allowing for earlier use than other IJA measures (e.g. pointing), and could potentially detect deviations in social behavior already during the first year of life. The study also highlights the potential of naturalistic paradigms in early ASD research.

1:27 **185.002** Feasibility of a Mobile Phone-Delivered Study of Social and Emotional Behaviors in Young Children at Risk for Autism

H. Egger[1]*, K. Campbell*[2]*, K. Carpenter*[2]*, J. Hashemi*[3]*, S. Espinosa*[3]*, M. Tepper*[3]*, J. Schaich Borg*[3]*, Q. Qiu*[3]*, S. Marsan*[2]*, G. Dawson*[2]*, R. Bloomfield*[3] *and G. Sapiro*[3]*,*

(1)Child and Adolescent Psychiatry, NYU Langone Medical Center, New York, NY, (2)Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC, (3)Duke University, Durham, NC

Background: Effective and accessible screening of young children for autism requires reliable, valid, and efficient tools for evaluation of a child's social-emotional behaviors. Coupling parent-report measures with evidence based observational assessments significantly improve the accuracy of screening and diagnosis. Current validated tools for structured assessment of children's behavior are expensive, training intensive, and time-consuming to administer. Development of tools for low-cost, automatic, objective, and quantifiable measurements of young children's observable behaviors has the potential to increase access to screening and early intervention for children around the globe.
Objectives: To test the feasibility of an iPhone application ("app") to engage parents directly in the collection of survey and video data about their children within their homes and use automatic computer vision algorithms to quantify children's emotions and attention in the uploaded videos.
Methods: Autism & Beyond, a study of young children ages 12 to 72 months, is an iOS app built on Apple's ResearchKit framework. The iPhone app includes self-guided econsent, parent-report surveys, and video activities with the child. The camera on the device recorded the child's behaviors and emotions as s/he watches short film clips while sitting on the parent's lap. Autism risk status of children in the study was based on parent-reported autism diagnosis and/or a positive M-CHAT-R/F (children 16-30 months). Behavioral variables automatically extracted from the videos include positive emotions, attention, and social referencing. Here we present results from first 6 months of the study.
Results: In the first sixth months of the study, 878 families met inclusion criteria. 295 children were in the high risk autism group (parent report of autism diagnosis: 218, high MCHAT: 51, Both: 26). Mean age of high risk children was 43.2 months (SD 14.9); mean age in the low risk group was 40.6 months (SD 16.4). The majority of parents were non-Hispanic/Latino Caucasians (65%), college educated (60%), and employed (63%). 862 participants completed additional surveys about child behaviors. 403 parents agreed to upload full videos of their child and completed at least one video activity with their child. 300 of 878 uploaded only facial landmarks extracted from their child's video. The child's face was identified in 84-92% of the video frames. Children in the high risk autism group showed decreased mean positive affect (-7%, SD 4%, p=0.04 in one stimulus) and lower predicted probability of social referencing (9% vs 24% p=0.02 at oldest ages in one stimulus).
Conclusions: Over 6 months, nearly 900 parents downloaded the study app, consented to participate, and completed study tasks in their homes. The quality of the video data is excellent. Automatic computer vision coding of emotions and head position in the videos enabled us to identify differences between children with and without a high risk for autism. These results are a first step toward the development of globally accessible, affordable, and easy to use app-based tools to improve the science and practice of screening for autism. Collaborations in South Africa and Argentina are enabling us to expand the reach of Autism & Beyond beyond the US.

1:39 **185.003** Imitation of Socially Rewarding and Non-Socially Rewarding Actions in Preschoolers with ASD

G. Vivanti[1]*, D. R. Hocking*[2]*, P. A. Fanning*[3] *and C. Dissanayake*[4]*, (1)AJ Drexel Autism Institute, Philadelphia, PA, (2)Psychology & Counselling, Developmental Neuromotor & Cognition Lab, La Trobe University, Melbourne, AUSTRALIA, (3)La Trobe University, Melbourne, Australia, (4)School of Psychology & Public Health, Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia*

Background: While imitation difficulties and atypical reward processing have been documented in preschoolers with ASD, the link between these phenomena is poorly understood. As imitation is a common treatment target and provision of contingent rewards is a common treatment procedure in ASD early intervention, a fine-grained understanding of how imitative responses in ASD are modulated by reward has the potential to provide critical insight on both mechanisms of impairment and mechanisms of treatment response in this population.
Objectives: We investigated how young children with ASD imitated actions that were either instrumental to achieve a non-social reward or a social reward compared to typically developing children and children with Williams Syndrome (WS). The aim was to identify whether putative imitation differences between the groups were (1) modulated by the social versus non-social nature of the demonstrated actions and (2) linked to learning outcomes in response to early intervention in ASD.
Methods: Â Participants were 35 preschoolers with ASD and 20 peers with WS, matched for age, cognitive, verbal and motor functioning as well as 20 typically developing peers matched for chronological age. We tested participants' spontaneous imitation performance in response to a series of novel eye-tracking-based imitation tasks, in which the to-be-imitated actions achieved either a non-social reward (obtaining a desired toy from a container) or a social reward (shared enjoyment between the demonstrator and the imitator). In the ASD group, we also examined the extent to which individual differences in imitation were correlated to intervention gains occurring in the 12 months following the test.
Results: Â We found that children in the ASD group imitated actions that were instrumental to achieving non-social rewards as frequently as participants in the TD and WS groups. Conversely, imitation performance was lower in ASD compared to the control groups in response to the demonstration of actions accomplishing social rewards ($F(2, 67)= 9.87$; $p< .01$). Similarly, eye-tracking patterns were similar across groups in response the demonstration of actions achieving non-social rewards, while children in the ASD group were less focused on the model's face during the observation of actions achieving a social reward ($p<.05$). Imitative response to socially rewarding actions was associated with response to early intervention outcomes ($r=.7$, $p<.005$).
Conclusions: Atypical reward processing modulates imitation performance in ASD. Imitation of socially rewarding actions is distinctively impaired in young children with ASD and sensitivity to the socially rewarding nature of demonstrated actions is linked to early intervention outcomes.

1:51 **185.004** Positive Affective Response to Dynamic Smiling Faces in Young Children with Autism Spectrum Disorder

P. Heymann[1]*, S. Macari*[1]*, L. DiNicola*[1]*, E. Hilton*[1]*, A. Milgramm*[1]*, F. E. Kane-Grade*[2] *and K. Chawarska*[1]*, (1)Yale Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Yale child Study Center, New Haven, CT*

Background: Â Children with Autism Spectrum Disorder (ASD) are able to show a full range of emotions (Braverman, Fein, Lucci & Waterhouse, 1989) but in social situations they reportedly display less positive affect than typically-developing (TD) children (Snow, Hertzif, Shapiro, 1987). For example, children with ASD were less likely to smile back in response to their mothers' smiles (Dawson, Hill, Spencer, Galpert & Watson, 1990). Although this phenomenon has been observed in naturalistic settings, few studies have examined affective response to faces in experimental settings. High-functioning adults with ASD exhibited deficits in automatic mimicry of facial expressions when looking at static facial images (McIntosh, Reichmann-Decker, Winkeilman, Wilbarger, 2006). The current study aims to explore the effects of social and non-social dynamic stimuli on smiling in young children with ASD.
Objectives: To determine whether smiling differs in children with and without ASD while watching social and non-social stimuli. We hypothesized that the children with ASD would express fewer smiles than TD children, especially in response to dynamic faces.
Methods: Â 53 children (ASD, *n=25*, TD, *n=28*) between the ages of 20 and 78 months were shown a gaze-contingent eye-tracking experiment consisting of non-social (fractals) and social (faces) conditions.Â In the non-social condition, two fractal images were presented, one of which became dynamic when the child fixated gaze on it. Similarly, the social condition consisted of two neutral static faces one of which, when fixated upon, became dynamic and smiled. Each condition consisted of 128 trials. The child's positive affect (smiles) was coded offline for both conditions. Proportion of trials with smiles was calculated based on the number of trials in which the child smiled divided by the number of trials the child watched. The ADOS-2 Module 1 was administered to all children with ASD and their parents completed the Vineland-II.
Results: Â The ASD group expressed positive affect on 8.1% (*SD=11*) of face trials versus 5.2% (*SD=11*) of fractal trials, compared to 9.7% (*SD=13*) and 4.0% (*SD=5*), respectively, in the TD group. An ANOVA indicated a significant main effect of condition ($F(1,47) = 4.92$, $p=.032$), whereby both groups expressed more positive affect during the social than during the nonsocial condition, but no main effect of group ($F(1,47)=37.45$, $p = .993$). There was no group by condition interaction ($p=.522$). Furthermore, in the ASD group, smiles were significantly correlated with the Vineland-II Interpersonal V-Score ($r=.519$, $p=.019$) and with shared facial expressions on the ADOS-2 (composite score of the Responsive Social Smile and Facial Expressions Directed to Others items; $r=.423$, $p=.044$).
Conclusions: Young children with ASD expressed positive affect at rates similar to TD children in response to dynamic smiling faces. Smiling seems to be an indicator of adaptive social behavior in ASD, as those who smiled more at the faces stimuli tended to have better interpersonal relationships with peers and were able to share a range of affect in naturalistic situations. This study shows that measuring affective response to dynamic stimuli can provide useful insight into real-world social behaviors.

Oral Session - 12B
186 - Contributors to Social Processing Deficits in ASD

2:10 PM - 3:00 PM - Yerba Buena 7

Session Moderator: Bhismadev Chakrabarti, *School of Psychology and Clinical Language Sciences, University of Reading, Reading, United Kingdom*

2:10 **186.001** Exploring Sex Differences in Social Attention in ASD

H. L. Hayward[1]*, L. Mason*[2]*, A. San Jose Caceres*[3]*, R. Holt*[4]*, M. C. Lai*[5]*, S. Baron-Cohen*[6]*, J. K. Buitelaar*[7]*, D. G. Murphy*[8] *and E. Loth*[9]*, (1)Institute of Psychiatry Psychology and Neuroscience, King's College London, London, England, United Kingdom, (2)CBCD, Birkbeck, University of London, Gravesend, UNITED KINGDOM, (3)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Autism Research Centre, University of Cambridge, Cambridge, UNITED KINGDOM, (5)Psychiatry, University of Toronto, Toronto, ON, CANADA, (6)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (7)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands, (8)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (9)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background:
Autism Spectrum Conditions (ASC) are estimated to affect males about 3 times more often than females. The majority of previous studies only studied males and only recently have systematic investigations of females with ASC begun (Lai, et al, 2015). Sex differences have been found in aspects of social cognition, such as empathy (Baron-Cohen et al, 2004). However, so far, sex differences not been explored in social motivation (often measured as spontaneous social attention), which has been proposed to also underpin social-communicative impairments.
Objectives:
1. To examine sex differences in social attention across different ages; 2. To investigate whether abnormalities in social attention relate to level of social-communicative impairments and/or level of social adaptive function in males/females.
Methods:
Participants with ASC (199 males, 78 females) and age-matched typically developing (TD) participants (151 males, 71 females) were recruited as part of the EU-AIMS Longitudinal European Autism Project (LEAP). An eye-tracking battery included a set of 6 still images of naturalistic social scenes, each presented for 15 seconds. Eye movements were recorded using Tobii eye-trackers. Areas of Interests (AOIs) focused on the whole face, eye region, mouth, relevant objects (defined by their role in a social interaction) and irrelevant objects. IQ was assessed using the WASI, autism social symptom severity using the parent-report Social Responsiveness Scale (SRS), and level of adaptive functioning using the Vineland Adaptive Behaviour Scale (VABS-III). To test our predictions, 2 (group) x 2(sex) x 3 (age group: child, adolescent, adult) between-subject ANOVAs were used.
Results:
We found a significant effect of group on % gaze time on faces ($F(1,487)=8.898$, $p=.05$, $r=.02$) and a significant group x age interaction ($F(2,487)=3.946$, $p<.05$, $r = .01$). Only TD adults looked longer at faces than adults with ASC, while there were no significant group differences in children and adolescents. In both groups, females looked longer at eyes ($F(1,487)=3.729$, $p=.05$, $r=.01$) than males. However, post-hoc analyses suggested that this pattern was only found during childhood. Gaze time on relevant/ irrelevant objects decreased with age, except for TD females: TD females looked longer at relevant objects than any other group during childhood but shorter during adolescence.
In the ASC group, % gaze on the mouth region was related to higher social-communicative impairments ($r =.12$, $p=.05$) and higher levels of adaptive behaviour (VABS composite) ($r=.19$, $p=.01$). Among the TD group, longer looking times on faces was linked to lower social-communicative symptoms ($r=-.20$, $p=.05$) and higher levels of adaptive functioning (all
Conclusions:
In both groups, females looked longer at eyes than males. Contrary to expectations, these sex differences were only seen during childhood. We also found differential relationships between gaze times on face/ mouth and level of social-communicative symptoms in the ASC and control groups.
Background:
Autism Spectrum Conditions (ASC) are estimated to affect males about 3 to 8 times more often than females. The majority of previous studies only studied males and only recently have systematic investigations of females with ASC begun (Lai, et al, 2015). Sex differences have been found in aspects of social cognition, such as empathy (Baron-Cohen et al, 2004). However, so far, sex differences not been explored in social motivation (often measured as spontaneous social attention), which has been proposed to also underpin social-communicative impairments.
Objectives:
1. To examine sex differences in social attention across different ages; specifically the hypothesis that sex differences become more pronounced in adolescence/adulthood in both groups due to biological (Craig et al., 2007) and/or social factors (Gould & Ashton-Smith, 2011). 2. To investigate whether abnormalities in social attention relate to level of social-communicative impairments and/or level of social adaptive function in males/females.
Methods:
Participants with ASC (199 males, 78 females) and age-matched TD participants (151 males, 71 females) were recruited as part of the EU-AIMS Longitudinal European Autism Project (LEAP). An eye-tracking battery included a set of 6 still images of naturalistic social scenes, each presented for 15 seconds. Eye movements were recorded using Tobii eye-trackers. Areas of Interests (AOIs) focused on the whole face, eye region, mouth, relevant objects (defined by their role in a social interaction) and irrelevant objects. IQ was assessed using the WASI, ASD social symptom severity using the parent-report Social Responsiveness Scale (SRS), and level of adaptive functioning using the Vineland Adaptive Behaviour Scale (VABS-III). To test our predictions, 2 (group) x 2(sex) x 3 (age group: child, adolescent, adult) between-subject ANOVAs were used.
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We found a significant effect of group on % gaze time on faces ($F(1,487)=8.898$, $p=.05$, $r=.02$) and a significant group x age interaction ($F(2,487)=3.946$, $p<.05$, $r = .01$). Only TD adults looked longer at faces than adults with ASD, while there were no significant group differences in children and adolescents. A trend indicated that in both groups females looked longer at eyes ($F(1,487)=3.729$, $p=.05$, $r=.01$) than males. However, posthoc analyses suggested that this pattern was only found during childhood. Gaze time on relevant/ irrelevant objects decreased with age, except for TD females: TD females looked longer at relevant objects than any other group during childhood but shorter during adolescence.
In the ASC group, %gaze on the mouth region was related to higher social-communicative impairments ($r =.12$, $p=.05$) and higher levels of adaptive behaviour (VABS composite) ($r=.19$, $p=.01$). Among the TD group, longer looking times on faces was linked to lower social-communicative symptoms ($r=-.20$, $p=.05$) and higher levels of adaptive functioning (all $p=.05$),
Conclusions:
We found a trend suggesting that in both groups, females looked longer at eyes than males. Contrary to expectations, these sex differences were only seen during childhood. We also found differential relationships between gaze times on face/ mouth and level of social-communicative symptoms in the ASC and control groups.

2:22 **186.002** Investigating Gender-Specific Trajectories of Autistic Traits Across Childhood and Adolescence in a Large Birth Cohort

W. Mandy[1], *J. Heron*[2], *E. Pellicano*[3], *B. St. Pourcain*[4] *and D. H. Skuse*[5], *(1)University College London, London, United Kingdom, (2)School of Social and Community Medicine, University of Bristol, Bristol, United Kingdom, (3)Centre for Research in Autism and Education (CRAE), UCL Institute of Education, University College London, London, United Kingdom, (4)University of Bristol, Bristol, UNITED KINGDOM, (5)UCL GOS Institute of Child Health, London, UNITED KINGDOM*

Background:
Autism spectrum disorder (henceforth 'autism') is a dimensional condition, which sits at the extreme of the continuum of autistic traits (ATs) that extends throughout the general population. There is mounting evidence that autism presents differently in males and females (Lai et al., 2015).Â To date, almost all studies of autism sex/gender differences have been cross-sectional, with a lack of longitudinal research. Therefore, we investigated gender differences in AT trajectories across childhood and adolescence. We tested the opposing predictions of two hypotheses about the development of the female autistic phenotype:

1. The **female compensation hypothesis** - females with autistic difficulties develop strategies to manage their social difficulties, such that their ATs diminish over time (e.g., Mandy et al., 2012).
2. The **adolescent emergence hypothesis** - ATs in females become more overt later in development, such that their ATs escalate during adolescence (e.g., Asperger, 1943).

Current diagnostic criteria, which are largely based on male cases, are relatively insensitive to the female autism phenotype. Therefore, we included participants across the full range of AT severity, not just those with an autism diagnosis, to avoid a systematic bias against participants with female-typical autistic difficulties.
Objectives:
To study gender differences in the trajectories of ATs in a large general population sample across childhood and adolescence.
Methods:
Participants (N=9744) were girls (n=4784) and boys (n=4960) from the Avon Longitudinal Study of Parents and Children (ALSPAC), a UK birth cohort study. ATs were assessed aged 7, 10, 13 and 16 years using the Social Communication Disorders Checklist (SCDC), a widely used and psychometrically sound parent-report AT measure. These longitudinal data were modelled using latent growth curve and growth mixture models.
Results:
We observed different AT trajectories for males and females (Figure 1). A latent growth curve model showed that, controlling for IQ, non-autistic psychopathology and socio-economic status: (a) aged 7, males had higher ATs than females ($p<.001$); (b) males and females both showed a decline in ATs between 7 and 10 years; (c) females, but not males ($p<.001$), showed a substantial escalation in ATs between 10 and 16 years.
This same pattern of findings occurred when we investigated gender ratios of those with very high ATs. For example, aged 7 years, males had much higher odds than females of scoring ≥ 99th AT centile (OR = 6.15, 95% CI [5.44, 6.85]), but by 16 years females and males had similar odds of having ATs ≥ 99th centile (OR=1.18, 95% CI [0.56, 1.80]).
Growth mixture modelling revealed three trajectory groups (Figure 2): Class 1 (26% female) who showed elevated ATs across childhood and adolescence; Class 2 (50% female) who showed persistently low ATs across childhood and adolescence; and Class 3 (52% female) who showed escalation of ATs during adolescence.
Conclusions:
We present the first empirical evidence for the adolescent emergence hypothesis: a sub-group of girls showed substantial escalation of ATs between 10 and 16 years. This may partly explain why females tend to be diagnosed with autism later than males.

2:34 **186.003** What Is Best - Zebra Crossings or Shared Zones? Revealing Pedestrian Viewpoints on Two Uncontrolled Crossing Points.

*R. Earl[1], **S. J. Girdler**[1], M. Falkmer[2], S. L. Morris[3] and T. Falkmer[1], (1)School of Occupational Therapy and Social Work, Curtin University, Perth, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, Australia, (3)School of Physiotherapy and Exercise Science, Curtin University, Perth, Australia*

Background: Road crossing is considered a dangerous but necessary life experience for people with and without a disability. Whilst traditional urban landscapes segregate foot and motorized traffic, the pursuit of safer and more pleasant environments has promoted construction of shared traffic environments, or shared zones. Shared zones are characterized by absence of traditional markings segregating the road and footpath. Whilst negotiating a shared zone traffic users are expected to interact with each other. Safety in these environments requires traffic users to rapidly perceive, assess and respond to social stimuli. These abilities may be impacted by impairments in cognitive processing, such as autism spectrum disorders (ASD). Hence, these demands may cause increased anxiety during negotiation of a shared zone compared to traditional pedestrian crossings (zebra crossings), resulting in avoidance of these areas and restrictions in community mobility.
Objectives: To reveal the viewpoints of pedestrians as they pertain to uncontrolled crossing points, specifically shared zones and zebra crossings.
Methods: Â Q method identified and explored the viewpoints of pedestrians specifically relating to shared zones and zebra crossings; 62 participants with ASD (n=20), intellectual impairments (ID) (n=21), and without impairments (TD) (n=22) were asked to complete a series of tasks which required them to cross both a shared zone and zebra crossing. Afterwards, participants were asked to sort 44 predetermined statements about shared zones and zebra crossings onto a grid in a way that reflected their experiences. For this study each statement was supplemented with simple images to enhance understanding, Q methodology has successfully been used in the past to reveal the viewpoints of individuals with ASD in regard to driving and public transport.
Results: Â Analysis revealed two viewpoints for pedestrians with and without cognitive impairment. The first viewpoint of "Confident Users" revealed that those sharing this view (n[TD]=18, n[ASD]=15, n[ID]=6)) would not avoid either environment and were confident in their ability to negotiate both crossings. The second viewpoint consisted of 12 "Confident but wary" participants (n[TD]=2, n[ASD]=4, n[ID]=6) who while confident in their own knowledge of the road rules surrounding the two crossings were less confident negotiating a shared zone, as they did not trust in the knowledge and actions of drivers in this environment. There were 11 participants that did not load on either viewpoint (n[TD]=1, n[ASD]=1, n[ID]=9) .
Conclusions: Â Overall, while participants would not avoid shared zones some preferred to seek out zebra crossings, perceiving them to offer a safer and more secure crossing option. However, the perception of enhanced safety on zebra crossings may be deceiving under certain conditions, especially, if resulting in avoidance of shared zones with lower traffic speed. Pedestrians with ASD loaded in a similar manner to their typically developed peers, suggesting that deficits in social processing and functioning may not impact on perceived safety in traffic environments, such as the shared zone or zebra crossing, nor do these crossing environments negatively impact on this population's community access and mobility.

2:46 **186.004** Social Reinforcement Learning and Its Neural Modulation By Oxytocin in Autism Spectrum Disorder

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Background: Â Oxytocin (OXT) has recently been shown to enhance motivation and attention to social stimuli. These effects may have the potential to enhance social reinforcement learning (SRL), the core mechanism of behavioral interventions. It is unclear whether OXT can compensate for possible deficits in SRL in ASD and whether such compensatory mechanism is related to an increase in saliency towards social stimuli per se or to a modulation of the brains' reward circuitry (especially nucleus accumbens; NAcc), which is specific for social feedback. These questions are important for future interventions aiming to combine OXT and behavioral treatments in ASD.
Objectives: Â We investigated the potential of OXT to compensate for deficits in socially reinforced learning in ASD and its underlying neural mechanism in a social learning task, which allowed for the differentiation of social feedback stimuli and social stimuli as the target of learning.
Methods: Â Using functional Magnetic Resonance Imaging we assessed brain activation during performance of a probabilistic reinforcement learning task in 24 typically developing controls (TDC) and 15 patients with ASD (18-26 years) in a double-blind placebo-controlled cross-over design. Participants indicated whether social or non-social stimuli belong to category A or B and social or non-social feedback with non-100% contingencies was provided. Data were analyzed using computational modeling according to the Q-Learning model. From the behavioral data, trial-by-trial reward-prediction error (RPE) values were calculated. We assessed the correlation of brain activation with RPE values during feedback and brain activation related to the anticipation of reward during choice. Based on previous studies of RPE learning and anticipation of reward, we focused on brain activation in the nucleus accumbens using an ROI approach ($p<.05$, voxel level corrected for ROI).
Results: In the ASD group, OXT enhanced the correlation of the RPE signal with activation in the NAcc during social *feedback* despite the learning target being non-social, whereas in the TDC group this effect was found in the placebo (PLC) condition. The learning *target* being social did not show a modulation by OXT during feedback in ASD whereas in TDC, an enhanced correlation was found for non-social learning targets during OXT. Behaviorally, subjects from both groups demonstrated significant learning during the task across conditions. Patients with ASD showed better learning when the learning target was social rather than non-social in the OXT but not PLC condition.
Conclusions: Our results demonstrate that in ASD, OXT selectively enhances the correlation of the RPE with brain activation during social feedback, but no selectivity was evident for social stimuli as a learning target. In the TDC group, OXT had a rather attenuating effect. Hence, on the neural level, OXT may disrupt a functioning system in TDC whereas OXT rather compensates for deficits in ASD. Behaviorally, OXT had a facilitating effect in ASD for social learning targets but not social feedback. This pattern suggests that the modulatory role of OXT for social learning is not specifically tied to the learning target or feedback being social, although differential neural effects can be observed.

Oral Session - 13A
187 - Innovative Treatments for School-Aged Children
1:15 PM - 2:05 PM - Yerba Buena 8

Session Moderator: Elizabeth Laugeson, *Psychiatry, UCLA Semel Institute for Neuroscience & Human Behavior, Los Angeles, CA*

1:15 **187.001** A Randomized Trial of a Brief Attention Bias Modification Game to Improve Engagement to Social Stimuli for Children with Autism Spectrum Disorder

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Background: Reduced social attention in individuals with autism spectrum disorder (ASD) has been demonstrated as early as 12 months of age. This early bias to preferentially allocate attention to non-social objects compared to faces may be an underlying mechanism impacting upon the later development of later social-communicative behaviors. While reduced social attention has been used as both a diagnostic predicator and marker for change in clinical trials, there has been little research aiming to specifically target social attention biases to causally modify social behavior.
Objectives: The aim of this pilot study was to develop and test a novel game-based social attention bias modification paradigm to improve preferences for social stimuli in school-aged children with ASD.
Methods: Participants included 57 children (9 females) diagnosed with ASD aged between 5-12 years randomized to either a bias modification (n=30) or control (n=27) game. Gameplay consisted of 15 one minute trials (levels) on a touchscreen device where children learned to 'swipe' various social and non-social object characters into a score zone. Children playing the bias modification game were rewarded with points for only swiping social characters, whereas children in the control condition were equally rewarded for either character type. Before and after gameplay children completed two eye-tracking tasks to assess change in eye gaze behavior towards social and object stimuli.
Results: Â Eye-tracking data was complete for 50 children; a further four children were excluded from analysis due to failure to complete gameplay (final sample game n=24, control n=22). In-game data confirmed children playing the bias modification game selectively swiped social characters preferentially over objects at game cessation, whereas children in the control condition indiscriminately selected both sets of characters ($t(44)=8.50$, $p<.001$). A significant interaction was observed between groups before and after gameplay on the percentage of engagements (first fixations) to faces, associated with a small effect size; $F(1, 44)=6.15$, $p=.02$, partial $\eta^2=.12$. Follow-up comparisons indicated that children playing the game significantly increased the percentage of engagements to social stimuli relative to objects after gameplay ($p=.04$) compared to children in the control condition ($p=.15$). Although there were no significant differences between groups in overall fixation times to social and object stimuli, exploratory pairwise comparisons indicated that children in the game group tended to decrease total fixation time towards objects after gameplay relative to the control condition ($p=.02$, partial $\eta^2=.12$).
Conclusions: Â This pilot study represents the first attempt to use a brief attention bias modification game to change attention to social stimuli in children with ASD. Preliminary data suggest that brief gameplay increased the tendency to engage with social stimuli and decreased exploration of objects. Further testing is now needed to determine whether extended gameplay can maintain these social attention changes. The implications for modifying attentional biases in a game-based format will be discussed as a potential novel mechanism to alter fundamental social-communicative behaviors such as eye contact, social preference, or emotion recognition.

1:27 **187.002** The Pegasus Psychoeducational Programme for Young People Diagnosed with Autism Spectrum Condition

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Background:
To promote empowerment and reduce self-stigma when a young person is diagnosed with autism spectrum condition (ASC) it is essential that they receive psychoeducation, to help them learn about their diagnosis in a positive way. Until recently there were no evidence-based guidelines on how to communicate the diagnosis of ASD to children or their parents. Neither were there any psychoeducational packages available for this purpose. We designed and evaluated PEGASUS, a group psychoeducational programme for young people with ASC. PEGASUS focuses on capacities as well as difficulties: it emphasises that having ASC means being different, but not inferior, to people without ASC. It is aimed at enhancing self-efficacy and development of compensatory strategies through understanding of individual strengths and areas of specific support needs.
Objectives:
The study's main objective was to evaluate the efficacy of PEGASUS. The design of our novel intervention is based upon principles of self-management and cognitive behavioural therapy (CBT). The programme comprises 6 weekly sessions, each lasting 1.5 hours with separate parallel sessions for children and for parents. We aimed to evaluate the acceptability of the intervention to children and their parents. We aimed to evaluate the extent to which participants could acquire a balanced understanding of the child's unique strengths and difficulties and to enhance self-management strategies tailored to that child's individual needs.
Methods:
In total, 48 children (9-14 years) with diagnoses of High Functioning Autism or Asperger's Syndrome and their parents were recruited. Half were randomised to attend the PEGASUS groups and half to the control group, in which they were offered no input over and above "treatment as usual". In total, five PEGASUS groups each including 4-6 children were run. Primary outcomes are of ASD knowledge and ASD-related self-awareness were assessed using a questionnaire specially developed for this study (the Autism Knowledge Quiz). This was completed by both children and their parents. Children also completed the Rosenberg Self-Esteem Scale, a self-concept scale and the Strengths and Difficulties Questionnaire (SDQ). Parents completed the SDQ, the Social Responsiveness Scale, the Parental Stress Index, a measure of parental self-efficacy and a measure of utility of ASD diagnosis. Data were collected at 3 time points: at baseline, after 3 months (i.e. immediately post-treatment) and at 6-month follow-up, by researchers blind to group allocation. The Vineland Adaptive Behaviour Scale was administered at baseline and at 6-month follow-up.
Results:
At the end of PEGASUS, ASC knowledge (β=.29, p<.001, 95% CIs [.13, .44]) and ASC self-awareness (β=.42, p=.001, 95% CIs [.17, .67]) increased significantly for those who attended PEGASUS (n=24) compared to controls (n=24). This effect persisted at follow-up, three months after PEGASUS ended.
Children who attended PEGASUS reported more ASC-related personal strengths than did controls and PEGASUS did not cause any reduction in self-esteem.
Conclusions:
PEGASUS enhanced participants' general knowledge of ASC and awareness of their own unique strengths and difficulties. This RCT provides initial evidence for PEGASUS's efficacy as a psychoeducation programme for people with ASC.

1:39 **187.003** Theatre of Mind: Results from a Large Randomized Control Trial of a Theatre-Based Intervention Showing Improvement in Social Cognition and Behavior in Youth with Autism Spectrum Disorder

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Background: Individuals with Autism Spectrum Disorder (ASD) are impaired across many levels of social competence, to include social cognition and the ability to perceive and respond to others. Theory of Mind (TOM) is the ability to attribute mental states including beliefs, intentions, desires, and knowledge to oneself and others and to understand that these perspectives are different from one's own. Theatre techniques such as role-playing, improvisation, and character development have been shown to enhance TOM skills in typically developing children. SENSE TheatreÒ, a peer-mediated, theatre-based intervention has resulted in significant improvement in social competence in children and adolescents with ASD (Corbett et al., 2016a) as well as reduction in anxiety related to engaging with peers (Corbett et al., 2016b).
Objectives: The purpose of the study was to examine the impact of a peer-mediated, theatre-based intervention, SENSE TheatreÒ, with a large sample of participants with high-functioning ASD using a randomized control trial (RCT) design. It was hypothesized that significant differences between the Experimental (EXP) and the Waitlist Control Group (WLC) would be found for measures of social cognition (TOM), social brain (ERP, Incidental Face Memory (IFM)), social behavior (Cooperative Play), and social functioning (SRS).
Methods: Participants included 80 high-functioning youth with ASD between 8-to-16 years randomly assigned to the EXP (N=43) or the WLC (N=37) group. The 10-session treatment involved theatrical approaches and behavioral strategies, implemented by trained typically developing peers. The primary dependent measures were the NEPSY TOM, including the Verbal (TOM-V) and Contextual (TOM-C) components, IFM, Cooperative Play from the Peer Interaction Paradigm, and the SRS. Analysis of Covariance was used in which the post-intervention score served as the outcome variable, group (EXP/WLC) as a main independent variable, and baseline (pre-intervention) score as a covariate.
Results: The two groups did not differ with regards to age, gender, or symptom profile measured by the Autism Diagnostic Observation Schedule, all p >0.05. However, significant differences between the EXP and the WLC group were observed post-treatment on multiple measures. Specifically, the EXP group showed better performance on the TOM Total $F(2,75)=5.96$, $p=0.02$ and on the TOM-V $F(2,76)=4.54$, $p=0.04$. Regarding social brain IFM, the EXP group showed greater memory for faces $F(1,78)=3.92$, $p=0.05$. In the domain of social behavior, the EXP group engaged in more cooperative play with novel peers $F(2,77)=7.49$, $p=0.008$, and demonstrated more social communication in daily functioning (SRS; $F(2,75)=3.81$, $p=0.05$).
Conclusions: Youth that participated in the treatment were better able to verbalize and attribute mental states and behaviors to others, engage in more cooperative play with peers, and exhibit more daily social communication in community settings. The study replicates and extends previous findings showing that the peer-mediated, theatre-based intervention contributes to improvement in multiple areas of social competence. The results contribute to a modest albeit expanding literature showing the promise of theatre for treating core deficits in youth with ASD.

1:51 **187.004** School-Based RCT Peer Social Intervention for Minimally Verbal Children with ASD

N. Bauminger-Zviely*, Bar-Ilan University, Ramat Gan, ISRAEL*

Background:
Few interventions have been specifically designed for school-age children with ASD who are minimally verbal (MVASD), namely who produce only 20-30 spoken words and/or stereotyped phrases. Within this neglected research area on the spectrum, interventions oriented at peer interaction for MVASD are even more overlooked, despite this population's severe social withdrawal and lack of spontaneous communication. To date, school-age MVASD intervention was adapted from preschool ages, targeted promotion of spoken words, mainly focused on child-adult interaction, and rarely used RCT (Tager-Flusberg & Kasari, 2013).
Objectives:
This study examined the efficacy of a novel manualized RCT, a school-based peer social intervention (S-PSI) designed specifically for MVASD. Its major aim was to increase minimally verbal children's ability to spontaneously interact with peers via preferred communication channels (sign language, computer, tablet, gesture, writing). The study compared two intervention groups targeting core ASD areas of social deficiency – social conversation (*Convers.*) vs. social collaboration (*Collab.*) – vs. a delayed treatment (*Control*) group. Contrasting the two interventions and comparing with controls aimed to identify which children benefited most from each intervention.
Methods:
N=54 participants with MVASD (8-16 years, Peabody receptive language: 37-101; Raven performance IQ: 38-127) were randomly assigned to one of three groups (*Convers., Collab., Control*, *n*=18 per group). Manualized interventions included 60 lessons over 15 weeks (4 per week) in children's special education schools, implemented by children's teachers and supervised by the research team. Both interventions emphasized peer-interaction in fixed peer-dyads matched for preferred communication channel, combining learning and practice with fun activities and games. The *Convers.* group focused on rules, topics, question asking, etc., whereas the *Collab*. group focused on working together, sharing, helping, etc. Children's pretest-posttest improvement in spontaneous peer-interaction was measured by social and communication scales (Vineland Adaptive Behavior Scale, Sparrow et al., 1984) completed by teachers who did not participate in treatment, and research team's direct observation of children's free-play social interactions. Several secondary outcomes were also measured, including children's executive functions and metacognitive abilities (EF-BRIEF, Gioia et al., 2000).
Results: Â Preliminary results demonstrated significant Group X Time effect for the overall Vineland, with *Convers.* showing significant gains, *F*=6.33, *p*<.05, *Collab.* showing near-significant improvement, *F*=3.46, *p*=.069, and *Contol* showing no significant change over time. Gains over time also emerged in Vineland-social subscales: for both intervention groups in interpersonal relationships (*Convers.: p*=.05; *Collab.: p*=.008) and for *Convers.* in play and leisure time (*p*=.011). Results of observations are still undergoing between - and within-group analyses (e.g., by Receptive and performance IQ, CA, EF) to identify who benefited most from which intervention. Interesting trends emerged on the EF-BRIEF, with the *Control* group showing regression over time in planning, organization, and monitoring, whereas the *Convers.* group showed gains in organization and monitoring.
Conclusions:
This S-PSI was the first school-based RCT to increase spontaneous peer-interaction that was directly oriented towards the needs of minimally verbal children along the spectrum. Preliminary results are positive. Strengthening these school-age children's ability to interact more spontaneously with peers holds promise for reducing this high-risk population's social withdrawal.

Oral Session - 13B
188 - Evaluating Outcomes in Social Skills Training
2:10 PM - 3:00 PM - Yerba Buena 8

Session Moderator: Elizabeth Laugeson, *Psychiatry, UCLA Semel Institute for Neuroscience & Human Behavior, Los Angeles, CA*

2:10 **188.001** Adolescents with Autism Spectrum Disorder and Social Skills Groups at School: A Randomized Trial Comparing Intervention Approach and Peer Composition

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Background:
Social relationships become increasingly complex during adolescence (Rodkin & Ryan, 2012). Adolescents with autism report having poorer peer relationships, including fewer friends, and less satisfying companionship with their friends compared to typically developing adolescents of the same age (Bauminger & Kasari, 2000). Within general education settings these students report fewer reciprocal friendships (Chamberlain, Kasari & Rotheram-Fuller, 2007), greater loneliness at school (Bauminger & Kasari, 2000), and poorer friendship quality (Bauminger & Kasari, 2000; Chamberlain et al, 2007; Locke et al, 2010) than their classmates. Studies that examine social skills interventions for adolescents with autism generally take place in clinic settings (Laugeson et al., 2014; White, et al., 2013). In the current study, we examined the efficacy of implementing social skills interventions for adolescents with autism at school.
Objectives:
The purpose of this study was to test the effectiveness of two distinct models of social skills group interventions (SKILLS and ENGAGE) with an ethnically and economically diverse group of school age adolescents with autism.
Methods:
We used a randomized controlled multi-site study to compare two different school-based social skills interventions for adolescents with autism. Sixty-one adolescents (ages 13-17) with autism without cognitive impairment participated in the study. Participants were ethnically diverse (Black = 8%, white = 43%, Hispanic = 9%, Asian = 21%, and other or mixed = 14%), and were educated in secondary school general education classrooms. After meeting eligibility criteria, participants were randomized to either a SKILLS or an ENGAGE condition. All group members in the SKILLS condition had a diagnosis of autism. The ENGAGE condition was peer-mediated, and the group consisted of adolescents with autism and typically developing adolescents. Data were collected prior to the start of the intervention, at the end of the intervention, and at fourteen weeks later. Groups met one time a week for eight weeks during lunch or afterschool. Peer engagement states (Joint Engagement, Parallel, and Solitary) were the primary outcome variables.
Results:
We used a linear mixed model with random effects for each participant, and main effects for time, site, treatment, race and a three-way interaction of time-by-treatment-by-race. We found differences approaching significance in Joint Engagement during unstructured times, indicating that the SKILLS intervention increased the Joint Engagement of Caucasian participants, but decreased Joint Engagement in Asian participants (p-value=0.06). There was a significant interaction of treatment by time by race interaction (p-value=0.02, chi-square (4)=12.24). The ENGAGE intervention was effective in raising Parallel for both Caucasian and Asian students, but it seemed to have a negative effect for the other racial groups. Similar effects were identified in Solitary engagement. There was a difference of treatment over time by racial group controlling for site (p-value=0.006). Non-white or Asian decreased their Solitary engagement more than Caucasian or Asian participants.
Conclusions:
Results support the efficacy of social skills interventions for adolescents with autism at school. However, findings highlight the heterogeneity existing within populations of students with autism in ethnically diverse schools. More research is needed to examine cultural factors that influence participant responsiveness to intervention.

2:22 **188.002** Evaluating Changes in Dynamic Social Interaction Skills Following a Randomized Controlled Trial of the START Socialization Intervention for Adolescents with ASD

***J. Ko**, A. Miller, A. Barrett, E. McGarry and T. Vernon, University of California Santa Barbara, Santa Barbara, CA*

Background: Treatment outcomes of interventions for Autism Spectrum Disorder (ASD), as well as social interventions in particular, have been primarily evaluated using parent report measures (Miller et al. 2014). These measures, while serving as valuable indicators of improvement, have notable limitations related to social desirability and other reporting biases (Moskowitz, 2006). Consequently, researchers are calling for more rigorous measurement tools to assess the effects of interventions (e.g. Lord et al., 2005; McMahon et al., 2013). Behavioral observations provide an objective and quantifiable outcome measure that can augment traditionally used survey measures. Systematic coding of observed behaviors during live social exchanges may offer a rigorous method for assessing changes in social competence.
Objectives: This study used direct observation of dynamic social interaction skills during video-recorded conversations to assess the efficacy of a randomized controlled trial (RCT) of the Social Tools and Rules for Teens (START) socialization intervention for adolescents with ASD.
Methods: Thirty-five adolescents with high-functioning ASD, ages 12-17 years, were enrolled in an RCT of the START program. Adolescents were randomized to either a treatment or waitlist group. The 20-week group intervention took place once a week for 90-minutes per session. Five-minute “get to know you” conversations between participants and similar-aged students, whom they have never met, were video-recorded at pre-intervention and post-intervention. Trained and reliable research assistants, but blind to condition and time point, systematically coded the videos for three types of social behaviors targeted during the intervention: question asking, mutual engagement, and positive facial expressions. An ANCOVA, using pre-intervention values of each social behavior as the covariate, compared the outcomes of the treatment and waitlist groups on the target social behaviors to examine if there was a difference. Paired samples t-tests were performed to examine the whole cohort of adolescents who completed the START program, and assess differences between pre-intervention and post-intervention.
Results: Results of the ANCOVA revealed a significant treatment effect for both question asking and positive facial expressions ($p < 0.05$). These skills additionally exhibited significant moderate to strong positive correlations (r values ranging from 0.47 to 0.61) with peer ratings of social ability ($p < 0.01$), which were made by blind observers after watching the video-recorded conversations. Examining the whole cohort collectively revealed significant increases in all three social behaviors from pre-intervention to post-intervention ($p < 0.05$).
Conclusions: To our knowledge, this study presents the first RCT utilizing behavioral coding of dynamic social exchanges to assess the efficacy of a social intervention for adolescents with ASD. Overall, the START program appears to positively impact the use of several verbal and nonverbal conversational strategies that are crucial for both social skill development and positive social impressions. Behavioral coding of specific target behaviors allows an unbiased, directly observable method for measuring social change that cannot be adequately captured by survey measures alone but serves to supplement the results from these measures. These findings provide evidence that these specific social behaviors may be linked to social desirability in every day interactions.

2:34 **188.003** Changes in EEG Asymmetry, ERP to Affective Stimuli, and Social Motivation and Cognition in Young Adults Completing PEERS® Intervention

***B. Dolan**[1], A. Barrington[1], H. K. Schiltz[1], A. McVey[1], S. Stevens[2], K. A. Willar[3], J. S. Karst[4], W. Krueger[1], C. Suhling[1], D. Snyder[1], R. McKindles[1], K. Reiter[1], S. Potts[1], C. Caiozzo[1], A. D. Haendel[5], S. Timmer-Murillo[1], S. Chesney[1], N. Gordon[1] and A. V. Van Hecke[1], (1)Marquette University, Milwaukee, WI, (2)University of Minnesota Medical School, Blaine, MN, (3)Children's Hospital Colorado, Aurora, CO, (4)Medical College of WI, Wauwatosa, WI, (5)Interdisciplinary PhD program (Psychology and Biomed Science), Marquette University, Milwaukee, WI*

Background: Social challenges amongst adults with ASD lead to isolation, lack of friendships, and emotional difficulties (Venter, Lord, & Schopler, 1992). The *Program for the Education and Enrichment of Relational Skills for Young Adults* (PEERS®: Gantman, Kapp, Orenski, & Laugeson, 2012) teaches verbal young adults with ASD the social skills needed in order to make and keep friends. The program was based on PEERS® for adolescents (Laugeson & Frankel, 2010). One study (Van Hecke et al., 2013) found that adolescent PEERS® participants showed changes in EEG (electroencephalogram) asymmetry, indicative of more relative left hemisphere activation, that was also related to social contact gained from the program.
Objectives: No published studies have evaluated the effects of PEERS® for Young Adults on brain function. This study will examine how PEERS® affects measures of EEG asymmetry and ERP (evoked response potential). This study also seeks to understand whether behavioral improvements from the intervention are related to changes in EEG asymmetry and ERP.
Methods: The analysis included 32 young adults with ASD (18 to 26 years old), split evenly between the Experimental Immediate treatment (EXP), and the Waitlist Control (WL) group. All participants had a verbal IQ > 70 and diagnoses were confirmed with the ADOS. The intervention was a randomized controlled trial (RCT) of PEERS® for Young Adults. Measures were taken at pre- and post-intervention and included: (1) the *Social Responsiveness Scale* (caregiver report; SRS: Constantino, 2005); (2) a 3-minute resting state EEG, from which frontal and temporal-parietal alpha asymmetry were calculated, and (3) and an ERP paradigm utilizing positive and negative social/nonsocial IAPS (International Affective Picture System: Lang, Bradley, & Cuthbert, 2008).
Results: A significant time by group interaction for alpha asymmetry in the temporal-parietal region was found ($F(1, 19) = 4.37$, $p < .05$), indicating a relative increase in left-hemisphere activity in the EXP group, versus a decrease in the WL group. Higher relative activity in the left temporal-parietal region at post-treatment was significantly related to better SRS Social Cognition at post-treatment ($r(21) = .49$, $p < .05$) and improvements in SRS Social Motivation ($r(21) = -.45$, $p < .05$).
Preliminary analysis of available ERP data indicated a significant time by group interaction on P300 responses to social, positive IAPS images, which was driven by an increase in P300 amplitude for the EXP group, vs. a decrease for the WL group. Planned analyses will include two additional cohorts of young adults to further assess PEERS®' effects on caregiver-report on the SRS, as well as augment EEG asymmetry and ERP analyses.
Conclusions: Young adults receiving the PEERS® intervention demonstrated significant changes in EEG asymmetry and ERP to social, positive images, and levels of asymmetry after conclusion of the intervention were related to caregiver reports of social motivation and cognition. The results from this study corroborate neural outcomes of PEERS® reported on adolescents with ASD (Van Hecke et al., 2013).

2:46 **188.004** Caregiver Vs. Adolescent Report of Internalizing Symptoms and Relationship to Physiological Arousal Across the PEERS® Intervention

A. Arias[1], *A. McVey*[1], *H. K. Schiltz*[1], *A. D. Haendel*[2], *B. Dolan*[1], *K. A. Willar*[3], *S. Stevens*[4], *J. S. Karst*[5], *A. M. Carson*[6], *F. Mata-Greve*[1], *E. Vogt*[1], *K. M. Rivera*[1], *E. Habisohn*[1], *J. Hilger*[7], *N. Fritz*[1] *and A. V. Van Hecke*[1], *(1)Marquette University, Milwaukee, WI, (2)Interdisciplinary PhD program (Psychology and Biomed Science), Marquette University, Milwaukee, WI, (3)Children's Hospital Colorado, Aurora, CO, (4)University of Minnesota Medical School, Blaine, MN, (5)Medical College of WI, Wauwatosa, WI, (6)Baylor College of Medicine/Texas Children's Hospital, Houston, TX, (7)Illinois State University, Normal, IL*

Background: Self- and parent/caregiver-report measures are commonly used to assess symptoms of anxiety and depression among adolescents with ASD. However, agreement in these reports has been found to be low (May et al., 2015). Respiratory Sinus Arrhythmia (RSA) and Heart Period (HP) are used to measure physiological arousal associated with anxiety and depression (Licht et al., 2009). In the present study, RSA and HP were used as a more "objective" reference point for the base level of adolescent anxious and depressive symptoms. No known study to date has examined change in discrepancy of self- and parent/caregiver-report measures over the course of a well-validated social skills intervention.
Objectives: Â 1) Determine discrepancies between adolescent self- and parent/caregiver-report of anxious and depressive symptoms at pre- and post-intervention. 2) Explore how two measures of physiological arousal, RSA and HP, compared to self- and parent/caregiver-report at both time points. 3) Examine change in discrepancies in report from pre- to post-intervention.
Methods: 139 adolescents with ASD aged 11-16 and their parents/caregivers participated. Descriptive statistics are in Table 1. A randomized controlled trial (RCT: experimental vs. waitlist control) of the PEERS® intervention (Laugeson & Frankel, 2010) was conducted. Data at pre- and post-PEERS® included self- and parent/caregiver-report of the Social Anxiety Scale-Adolescent (SAD-NEW, fear and anxiety about unfamiliar peers), Spence Children's Anxiety Scale (SCAS), Short Mood and Feelings Questionnaire (SMFQ) and Child Behavior Checklist (CBCL)/Youth Self Report (YSR) Anxious/Depressed, Withdrawn/Depressed, Internalizing Problems subscales, as well as RSA and HP from a sub-sample of participants ($n_{overall}=63$; $n_{waitlist}=29$).
Results: Preliminary results revealed the following effects and correlations. Repeated Measures ANOVAs for Group (EXP vs WL) by Reporter (Parent/caregiver vs. Teen) showed significant main effects for Reporter on the SAS-NEW at Pre, $F(1,117)=23.47$, $p<.001$ and Post, $F(1,122)=48.22$, $p<.001$; Spence at Pre, $F(1,54)=17.51$, $p<.001$; CBCL/YSR Anxious/Depressed at Post, $F(1,44)=7.26$, $p=.01$; CBCL/YSR Withdrawn/Depressed subscale at Post, $F(1,44)=6.17$, $p=.02$. Correlations between behavioral measures and RSA at both time points revealed a significant relationship between RSA and EXP parent/caregiver reports at Post on the CBCL Internalizing Problems subscale, $r(32)=-.585$, $p=.036$, and the Anxious/Depressed subscale, $r(32)=-.645$, $p=.017$. No other correlations were significant.
Conclusions: Results demonstrate reporter discrepancies and correlations between RSA and parent/caregiver-reports. Because no significant correlations in RSA and self-report were uncovered, and lower values of RSA are shown to be associated with higher anxiety, parents/caregivers may be more accurate in reporting adolescents' symptoms post-intervention. This may be a byproduct of the intervention's focus on behavior that results in parents/caregivers recognizing their adolescent's social difficulties more accurately. Discrepancies present prior to intervention may be the result of parent/caregivers' difficulty in recognizing internalizing symptoms (Sourander, Helstelä, & Helenius, 1999). At post-intervention, for the waitlist group, discrepancies on the CBCL/YSR subscales may be due to the parents/caregivers' perceived expectations of themselves in being part of a research study leading them to assess symptoms differently than at the pre- time point.

Oral Session - 14A
189 - Functional Connectivity in ASD: From Infancy to Adulthood
1:15 PM - 2:05 PM - Yerba Buena 9

Session Moderator: Shafali Jeste, *UCLA, Los Angeles, CA*

1:15 **189.001** Altered Patterns of Local Connectivity in Autism Measured By Regional Homogeneity

S. Nair, *R. K. Kana and N. Loomba, University of Alabama at Birmingham, Birmingham, AL*

Background: Disruption in functional connection has been a characteristic feature of brain functioning in autism spectrum disorders (ASD). Studies of regional homogeneity (ReHo), which measure local connectivity, in autism have provided somewhat inconsistent results. Previous reports of local overconnectivity in visual cortices during rest in ASD (Maximo et al., 2013; Keown et al., 2013) were not replicated in some studies using a large shared database ABIDE (Autism Brain Imaging Data Exchange) (DiMartino et al., 2013; Dajani & Uddin, 2015). However, eye status during rest was not accounted for in these studies (samples included both eyes open and eyes closed scans), and studies presented both standardized and unstandardized connectivity maps. Our recent study of subsamples from ABIDE showed variable patterns of posterior ReHo across eye status and processing pipelines (Nair et al., under review).
Objectives: To use a data-driven approach in examining the patterns of local brain connectivity in autism as a function of eye status and processing pipelines during resting state fMRI.
Methods: Resting state fMRI data from ABIDE-II database (Georgetown University sample) were preprocessed using standard processing stream, including motion correction, spatial and temporal filtering, and analysis was performed with global signal regression (GSR). Time points with motion >.5mm were censored, and participants with >80% time points remaining after censoring were included in the analysis. Participants were matched on age (8-14 years; M=11), IQ (93-147; M=116), and RMSD (.03-.14; M=.08), resulting in final samples of 31 ASD, 35 TD participants. Voxel-wise ReHo maps (AFNI's *3dReho*) were derived and standardized, and 2 two-sample t-tests were conducted for standardized and unstandardized ReHo pipelines.
Results: Standardized analysis yielded local overconnectivity in ASD in bilateral paracentral lobule, left precuneus and fusiform gyrus, left superior frontal gyrus, and left inferior parietal lobule (IPL). Local underconnectivity was detected in ASD in bilateral cuneus, right cerebellum and superior temporal gyrus.Â Unstandardized analysis yielded local overconnectivity in ASD in bilateral paracentral lobule and precuneus, left fusiform gyrus, IPL, middle temporal gyrus, inferior frontal gyrus, left cerebellum, and right middle frontal gyrus, and local underconnectivity in right cerebellum. Results were cluster-corrected using Monte Carlo simulations to obtain a corrected significance level of $p<.05$ (uncorrected $p<.01$) and cluster size of 41 voxels (AFNI's *3dClustSim*).
Conclusions: While DiMartino et al. and Dajani & Uddin reported overall patterns of local underconnectivity across posterior areas and overconnectivity across anterior areas (using mixed eyes open and eyes closed sample), both ReHo processing pipelines in the present study do not show such a distinct anterior-posterior pattern of local connectivity. This variable pattern of connectivity in standardized analysis is novel and interesting. Additionally, lateralization effects entailed general diffuse overconnectivity for left and underconnectivity for right hemisphere in ASD. These findings are preliminary and our future analyses will utilize low-motion, high quality eyes open and eyes closed data from ABIDE-II. Assessing differences across local connectivity studies in ASD in relation to our findings is important, as they may underscore effects of multisite data and methodological variability.

1:27 **189.002** Longitudinal Changes in Functional Connectivity in Autism Spectrum Disorder

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Background: Autism spectrum disorder (ASD) has consistently been linked to altered functional connectivity in the brain. However, there are conflicting results as to whether the autistic brain is characterized by increased or decreased connectivity. One recent theory argues that such discrepancies in the functional connectivity literature are due to an atypical developmental trajectory in ASD, as hyperconnectivitiy is more likely to be reported in studies focusing on children, and hypoconnectivity in studies focusing on adolescents or adults (Uddin et al., 2013). Evidence from structural brain connectivity and volumetric studies likewise support the possibility of an atypical developmental course from childhood through adulthood in ASD (Bakhtiari et al., 2012; Hua et al., 2013). However, all studies investigating the developmental trajectory of functional connectivity in ASD thus far have used cross-sectional samples. Yet longitudinal studies are crucial for better understanding how connectivity alterations in ASD may relate to age: longitudinal samples allow for greater sensitivity when mapping trajectories and comparing age groups, as well as greater confidence that age-dependent findings are not due to inherent differences between the subjects included in each age cohort
Objectives: Using a longitudinal sample, characterize how functional connectivity in key intrinsic connectivity networks (e.g. default mode network, DMN; salience network, SN) evolves from early- to late-adolescence in ASD relative to typical development, and investigate the extent to which observed patterns of atypical connectivity in ASD are age-dependent.
Methods: A total of 41 individuals completed a resting-state functional MRI scan in both early-adolescence and late-adolescence; the mean age at time point 1 was 12.74 + 0.92 years old, and the mean age at time point 2 was 15.8 + 0.93 years old. DMN functional connectivity was investigated using a seed located in the posterior cingulate cortex (PCC), and scrubbing was applied to reduce potential motion confounds (Power et al., 2012). Initial group comparisons, focusing on the DMN in a subset of these participants, were completed in FSL and prethresholded with a joint mask of the within group results. Connectivity z-scores were subsequently extracted from regions which displayed an effect of diagnosis and analyzed using a 2 (diagnosis) by 2 (time point) ANOVA.
Results: Both diagnostic groups displayed greater local connectivity with the PCC and angular gyrus in early-adolescence than in late-adolescence. Relative to the TD group, the ASD group displayed hyperconnectivity with the angular gyrus in early-adolescence, and hyperconnectivity of the PCC and medial prefrontal cortex in late adolescence. When extracting connectivity estimates, these regions displayed a significant interaction between diagnosis and time point such that the developmental trajectory of functional connectivity differed between the ASD and TD groups. Furthermore, the connectivity alterations present in ASD in early-adolescence were not present in late adolescence and vice versa when using this region-of-interest approach.
Conclusions: These initial results show distinct patterns of altered DMN connectivity during early vs. late adolescence, which may contribute to the age-dependence of atypical connectivity findings in ASD. Overall, these findings highlight the value of using a longitudinal design when assessing atypical developmental trajectories.

1:39 **189.003** Age-Dependent Alterations in Resting State Connectivity in the Broader Autism Phenotype - a Twin Study

J. Neufeld[1]*, P. Fransson*[2]*, R. Kuja-Halkola*[3]*, E. Cauvet*[1]*, K. Mevel*[4] *and S. Bolte*[1]*, (1)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Institutionen för kvinnors och barns hälsa (KBH), Karolinska Institutet, Stockholm, Sweden, (2)Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden, (3)Department of Medical Epidemiology and Biostatistics, Karolinska Institutet, Stockholm, Sweden, (4)Laboratory for the Psychology of Child Development and Education (LaPsyDÉ), CNRS UMR 8240, Sorbonne Paris Cité, GIP Cyceron, Université de Caen Normandie, Université Paris Descartes, Paris, France, Paris, France*

Background: Altered functional brain connectivity during the resting state (RS) has commonly been reported in individuals diagnosed with Autism Spectrum Condition (ASC). However, findings are largely inconsistent, showing both increased and decreased connectivity in various regions. Insufficient control for confounding factors, such as genetic and environmental influences, but also head motion during brain scanning (Power et al., 2012), potentially lead to biased results. Further, recent studies suggest that altered connectivity in ASC compared to typically developing (TD) individuals might be age-dependent (Nomi & Uddin, 2015; Dajani & Uddin 2015; Alaerts et al., 2015) while only few studies tested age-effects.
Objectives: The current study aims to specifically test connectivity within two RS networks commonly reported to be altered in ASC: the Default Mode Network (DMN) and the Salience Network (SN). In order to gain more conclusive results 1) a marked reduction of confounding is achieved using a twin design (Mevel et al., 2014) while 2) carefully controlling for head motion. Further, 3) in accordance with the Research Domain Criteria (RDoC) we focus on dimensional rather than categorical outcomes (Insel et al., 2010) and 4) stratification by age is applied in order to detect age-specific differences.
Methods: Monozygotic (MZ) and dizygotic (DZ) twins (N=150, 61.3%MZ; 64%male, age:8-23years, mean=16.2+/-3.3) underwent diagnostic (ADOS/ADI-R), as well as brain imaging assessments including RS fMRI (Bölte et al., 2014). Further behavioral investigations included IQ testing (WISC/WAIS) and autistic traits were assessed using the Social Responsiveness Scale (SRS). Functional images were pre-processed in AFNI, including nuisance signal regression (local white matter lateral ventricle signal) and motion-censoring. RS connectivity (temporal correlations) between major hubs of the DMN (posterior cingulate cortex: [-6,-44,34]; ventromedial prefrontal cortex: [-2,38,-12]) and the SN (right anterior insula:[39,23,-4]; anterior cingulate cortex: [6,24,32]), respectively, were calculated. Conditional linear regressions in R were used to model within-pair associations between RS connectivity and autistic traits while controlling for head motion and IQ. In a second step, analyses were repeated while stratifying by age (children: 8-13, N=44; adolescents: 14-17, N=62; adults: 18-23 years, N=44).
Results: A significant positive within-pair association was found in the whole sample between autistic traits and within-SN connectivity (i.e. between anterior insula and anterior cingulate cortex; β=0.003; Z=2.77; p=0.006; SEM=0.001). In contrast, a negative within-pair association between within-DMN connectivity (posterior cingulate to ventromedial prefrontal cortex) and autistic traits was found only after stratifying by age in adolescents (β=-0.002; Z=-2.24; p=0.025; SEM=0.001) and adults (β=-0.002; Z=-2.06; p=0.040; SEM=0.001) but not in children (β=0.00015; Z=1.426; p=0.154; SEM=0.001).
Conclusions: The results are in line with previous reports of altered RS connectivity in ASC and suggest SN and DMN connectivity as promising candidate biomarkers for ASC. They are further consistent with contemporary developmental models of ASC (Uddin, Supekar, and Menon, 2013), supporting the idea of early over-connectivity and under-connectivity later in life and underline the importance of testing for age effects. However, our results suggest that connectivity differences as well as developmental trajectories of the latter might be network-specific rather than generalizable across the brain.

1:51 **189.004** Decoupling of the GABA / Gamma Relationship during Development in ASD – the Impact of an Atypical Developmental Trajectory

T. P. Roberts[1]*, R. G. Port*[1]*, W. Gaetz*[1]*, L. Bloy*[1]*, L. Blaskey*[1]*, E. S. Kuschner*[1]*, E. S. Brodkin*[2] *and S. E. Levy*[1]*, (1)The Children's Hospital of Philadelphia, Philadelphia, PA, (2)Department of Psychiatry, University of Pennsylvania, Philadelphia, PA*

Background:
It is believed that neuronal ensemble oscillatory activity, recorded in-vivo using electrophysiological techniques such as electroencephalography (EEG) and magnetoencephalography (MEG), reflects the integrity of underlying local circuitry. Furthermore, the precise operation of such local circuitry is maintained by the delicate balance of excitatory and inhibitory influences, mediated by the neurotransmitters, glutamate and GABA.
Objectives:
The objective of this study is to observe the relationship between estimates of GABA levels, derived from edited magnetic resonance spectroscopy (MEGAPRESS-MRS), and gamma-band oscillatory activity elicited from cortex and recorded using magnetoencephalography (MEG). Specifically, the multi modal study is executed in both children (across a broad age range) and adults in order to determine both the developmental trajectory and ultimate asymptote of each measure, as well as their correlation, or coupling.
Methods:
Spectrally-edited MEGAPRESS MRS from voxels in superior temporal gyrus were obtained in children (age 6-14) and young adults (age 18-40) with ASD as well as typically-developing (TD) controls (N=42 ASD, N=32 TD). In the same subjects, gamma-band oscillatory activity elicited by simple auditory stimulation was recorded using magnetoencephalography and localized to auditory cortex using a beamforming algorithm. Dependent variables were GABA/Cr ratios for MRS and gamma-band phase-locking for MEG. Linear mixed modeling and hierarchical regression were performed across the age range as well as separately for children and adults.
Results:
Across the entire age-range, both GABA/Cr ratios and gamma-band phase locking values were significantly reduced in ASD vs. TD. For GABA/Cr: ASD=0.28+/-0.01, TD=0.31+/-0.01, F=7.93, p<0.01. For gamma-band phase locking: ASD=0.058+/-0.003, TD=0.067+/-0.003, F=4.94, p<0.05. Critically, while in TD children there was a strong coupling between GABA and gamma measures (robust regression, p<0.01), no such correlation was observed in children with ASD (p>0.05). Furthermore, in adults, there was a significant difference in gamma-band oscillatory phase locking between TD and ASD (0.069+/-0.04 vs. 0.57+/-0.004, F=5.25, p<0.01).
Conclusions:
Multimodal studies of neurochemistry and electrophysiology suggest a tight coupling of GABA levels and gamma-band phase synchrony during typical development, interpreted as the formation of intact cortical local circuitry. Consequently, in typical adulthood a high level of gamma-band phase synchrony is observed. Conversely, in ASD, such tight coupling is not observed during development; in adulthood gamma-band phase synchrony also appears to be reduced compared with TD controls. We conclude that there is a critical developmental window in childhood for the formation of local neuronal circuitry, which is associated with a tight association between GABA levels and gamma-band activity. This association is disrupted in ASD during development, with consequent reduction in electrophysiological evidence of local circuitry functioning in adulthood.

Oral Session - 14B
190 - Early Brain Development
2:10 PM - 3:00 PM - Yerba Buena 9

Session Moderator: Shafali Jeste, *UCLA, Los Angeles, CA*

2:10 **190.001** Altered Early Development of Resting-State Network Properties in Infants at High Risk for Autism Spectrum Disorder.

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Background: Graph theory is a quantitative technique to measure complex dynamics and small-world topology (i.e., segregation of nearby-networks and integration of more distant networks) between brain networks (Bullmore and Sporns, 2009). Prior studies with healthy neonates have applied graph theoretical analysis to characterize early development of functional networks (Gao et al., 2011; Fransson et al., 2011, De Asis-Cruz, 2015). These studies have shown that functional networks in neonates exhibit similar small-world characteristics as in adults, albeit with denser connections in sensorimotor hubs in infants and in association cortices in adults. However, little is known about early development of small-world topology in infants at elevated risk for autism spectrum disorder (ASD).
Objectives: Given prior studies implicating disrupted cortical connectivity in ASD etiology (Rudie et al., 2013, Kana et al., 2014), it is crucial to understand the evolution of small-world topology of functional networks in infants at high risk for ASD.
Methods: Resting-state fcMRI (rs-fcMRI) data were acquired during natural sleep for 8 minutes on a 3T Siemens scanner for 24 infant siblings (6 weeks post-birth) of children with ASD (i.e., high-risk group; HR) and 28 infants at low risk (LR) for ASD (i.e., no family history of ASD). Data were preprocessed using AFNI and FSL, including motion correction, spatial smoothing, isolation of low frequency fluctuations (.008<*f*<.08), and normalization to the UNC Infant 0-1-2 neonate atlas (Shi, 2011). Time-series were extracted for all voxels within 45 bilateral cortical and subcortical regions of interest (ROIs) using the same atlas. Correlations were computed between all ROI pairs resulting in a 45x45 functional connectivity matrix. Graph theory metrics were used to examine the density of connectivity between ROI pairs (i.e., the percentage of possible voxel in each ROI pair that are correlated above a specified threshold, r>.25, p<.001). Two sample t-tests were performed on z-transformed density values to identify group differences in connection density for each ROI pair.
Results: Consistent with prior studies, results indicated greater overall connection density for rs-fcMRI networks in sensorimotor and subcortical regions in both groups. Between-group comparisons revealed increased connection density for more ROIs pairs in the HR group as compared to the LR group. Specifically, regions involved in visual and sensorimotor processing (i.e., cuneus, middle occipital gyrus, paracentral lobule) demonstrated greater connection density in the HR group compared to the LR group. In contrast, the LR group showed greater connection density in temporal (especially fusiform gyrus) and prefrontal ROIs compared to the HR group.
Conclusions: Our findings suggest that functional network properties may be disrupted as early as the first weeks of life in infants at high risk of developing ASD. Further longitudinal assessment is required to determine if these early differences in connection density could serve as a biomarker in predicting which infants within the HR group will later meet criteria for diagnosis of ASD.

2:22 **190.002** Functional Neuroimaging in High-Risk 6-Month-Old Infants Predicts Later Autism

R. Emerson[1], *C. Adams*[2], *T. Nishino*[2], *H. C. Hazlett*[1], *J. J. Wolff*[3], *L. Zwaigenbaum*[4], *J. N. Constantino*[5], *M. D. Shen*[1], *M. R. Swanson*[6], *J. T. Elison*[3], *S. Kandala*[2], *A. Estes*[7], *K. Botteron*[8], *D. L. Collins*[9], *S. Dager*[10], *A. C. Evans*[11], *G. Gerig*[12], *H. Gu*[13], *R. McKinstry*[14], *S. Paterson*[15], *R. T. Schultz*[16], *M. Styner*[1], *B. Schlaggar*[2], *J. R. Pruett*[17] *and J. Piven*[1], *(1)Carolina Institute for Developmental Disabilities, University of North Carolina at Chapel Hill, Chapel Hill, NC, (2)Washington University, St Louis, MO, (3)University of Minnesota, Minneapolis, MN, (4)University of Alberta, Edmonton, AB, CANADA, (5)Department of Psychiatry, Washington University School of Medicine, St. Louis, MO, (6)Carolina Institute for Developmental Disabilities, University of North Carolina at Chapel Hill, Carrboro, NC, (7)University of Washington Autism Center, Seattle, WA, (8)Washington University School of Medicine, St Louis, MO, (9)Montreal Neurological Institute, McGill University, Montreal, QC, CANADA, (10)University of Washington School of Medicine, Seattle, WA, (11)Montreal Neurological Institute, McGill University, Montréal, QC, CANADA, (12)New York University, New York, NY, (13)University of North Carolina at Chapel Hill, Chapel Hill, NC, (14)Washington University, St. Louis, MO, (15)Children's Hospital of Philadelphia, Philadelphia, PA, (16)The Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (17)Washington University School of Medicine, Saint Louis, MO*

Background: Effective early interventions that can ameliorate the defining deficits of ASD and improve long-term outcomes rely on early detection. One barrier to early (i.e., prior to 24 months) detection is that the defining behavioral characteristics of ASD generally unfold during the second year of life, sometimes not showing consolidation of the full behavioral syndrome around 24 months or later.
Recent research using functional connectivity magnetic resonance imaging (fcMRI) has linked the functional organization of the human brain to individual cognitive profiles. These measures of brain functional connectivity are reliable and can accommodate participants as young as neonates. Furthermore, in conjunction with machine learning approaches, fcMRI data has provided predictions of brain maturation and diagnostic category at the single-subject level.
Objectives: We aimed to use functional neuroimaging with 6-month-old infants to identify which individual children will receive a research clinical best estimate diagnosis of ASD at 24 months of age.
Methods: Prospective neuroimaging and behavioral data were collected from 59 naturally sleeping infants at high familial risk for developing ASD. First, we defined functional connections in the 6-month-old brain that correlated with 24-month scores on assessments of social interactions, communication, motor development, and repetitive behavior – all features common to the diagnosis of ASD. We then used a fully cross-validated machine learning algorithm to demonstrate that fcMRI can identify 6-month-old infants who progressed to a clinical diagnosis of ASD at 24 months of age. For each infant, we defined brain features and trained a classifier using an independent set of 58 high-risk infants. We then predicted that infant's future diagnosis using only information from their 6-month functional neuroimaging scan. To test the generalizability and validity of our results, we used a similar classification analysis with a greater number of subjects held independent (leave-10-out).
Results: Â The overall classification accuracy for later ASD using functional connectivity data in 6-month old infants was 96.6% (95% CI 87.3–99.4, p<0.001). The positive predictive value of this approach was 100% (95% confidence interval [CI], 62.9–100), correctly predicting 9 of 11 infants who received a diagnosis of ASD at 24 months (sensitivity 81.8% [95% CI 47.8–96.8]).Â All 48 6-month-old infants who were not diagnosed with ASD were correctly classified (specificity 100% [95% CI, 90.8–100]; negative predictive value 96.0% [95% CI 85.1–99.3]). On average, the leave-ten-out analysis performed with 92.7 ± 0.7% accuracy.
Conclusions: These findings demonstrate the potential for early detection of autism in infants at high familial risk and serve as a proof-of-concept that patterns of infant brain measures precede the defining behavioral characteristics of ASD.Â Ultimately, this study represents an initial, but critical, first step toward developing infant diagnostic methods and enabling efficient tests of infant interventions.

2:34 **190.003** Early Developing Functional Connectivity Between Default Mode, Salience, Attention, and Visual Networks Underpins Autism and a Subgroup with Preference for Geometric Images and Lack of Social Orienting

M. V. Lombardo[1,2], *M. Datko*[3], *L. T. Eyler*[3], *C. C. Barnes*[3], *E. Courchesne*[3] *and K. Pierce*[3], *(1)University of Cyprus, Nicosia, Cyprus, (2)University of Cambridge, Cambridge, United Kingdom, (3)University of California, San Diego, San Diego, CA*

Background:
The way in which a toddler with autism (ASD) may atypically sample the social environment during the first years of life may play an important role in shaping experience-dependent neurobiological processes. Most typically-developing (TD) toddlers as well as some toddlers with ASD show early a visual preference for social images when given the choice to look at social versus non-social geometric visual displays. However, we have consistently found that there is a subgroup within early developing ASD toddlers (GeoASD) who atypically lack this preference for social stimuli in their first 4 years of life and instead prefer geometric images (Pierce et al., 2011, 2016). We predicted that this atypical lack of early social orienting may be underpinned by hypoconnectivity between large-scale neural circuits developing early specialization for visual, attention, salience, social cognition/communication functions.
Objectives:
To examine how ASD subgroups defined by early social or non-social geometric visual preferences measured via the GeoPref eye tracking test (Pierce et al., 2011, 2016) are differentiated in intrinsic functional connectivity measured with resting state fMRI (rsfMRI). We predicted hypoconnectivity in an ASD subgroup with preference for non-social geometric displays (GeoASD), particularly between visual, attention, salience, and default mode neural circuits.
Methods:
n=78 ASD (GeoASD n=16, nonGeoASD n = 62) and n=55 scan age and sex-matched TD individuals (age 12-48 months) were evaluated using the GeoPref eye tracking test and also had a 6 min 25 seconds rsfMRI scan during natural sleep. Data were preprocessed using AFNI and denoised by regressing out 6 motion parameters and their derivatives, CSF signal, as well as removal of further noise-related variability identified with wavelet denoising techniques (Patel et al., 2014, Neuroimage). Groups did not differ in mean framewise displacement or DVARS before and after denoising. FSL MELODIC Group Independent Components Analysis (ICA) and dual regression were utilized to identify networks as components. Nine components were identified as default mode, attention, salience, or visual networks and connectivity between these components was estimated with robust regression to be insensitive to outliers. Group differences were examined with ANOVA and multiple comparison correction (FDR q<0.05).
Results:
Confirming our hypotheses, we found significant effects of group for 7 of the total 36 comparisons (all F>8.84, all p<0.0035, all survive FDR q<0.05), involving default mode-visual, default mode-attention, and salience network connections. All effects followed an ordinal rank pattern of GeoPref<nonGeoPref<TD. Default mode-visual connections were significantly reduced in GeoASD compared to nonGeoASD or TD (i.e. GeoASD<nonGeoASD or GeoASD<TD) and for nonGeoASD compared to TD (all p<0.05). Group differences in default mode-attention connectivity as well as connectivity between salience components were driven primarily by more generalized hypoconnectivity in ASD compared to TD.
Conclusions:
ASD within the first 4 years of life is characterized by decreased functional connectivity between default mode subsystems and early developing visual and attention circuits as well as connectivity within the salience network. The main feature differentiating socially oriented nonGeoASD versus non-socially oriented GeoASD toddlers with ASD is further dampening of functional connections between the default mode subsystems and visual cortices.

2:46 **190.004** Fmri Reveals That Toddlers with an ASD Respond Abnormally in the Superior Temporal Sulcus to Social Orienting Stimuli during Natural Sleep

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Background: Â Unusual social responding, such as a failure to respond to name, is a red flag for autism spectrum disorders (ASD) in infants and toddlers, but the neural systems that underlie this deficit are under-studied. The superior temporal sulcus (STS) has been dubbed the “chameleon of the human brain” because of its involvement in many social tasks. It is unknown whether its dysfunction underlies social responding deficits at the time of first clinical signs of autism, and could thus serve as an early biomarker of risk for ASD.
Objectives: Â We aimed to test whether there were early socially-relevant neural differences between infants and toddlers later diagnosed with ASD and those who develop typically by comparing functional magnetic resonance (MR) brain response to social auditory stimuli compared to language and non-social sounds.
Methods: Â A population-based screening method and community referral identified toddlers at risk for an ASD as young as 12 months, and children were followed until their third birthday for final diagnostic judgment. ASD and typically developing (TD) comparison children (12-48 months old) were scanned with MR imaging during natural sleep. Blood oxygen level dependent (BOLD) images were acquired during auditory stimulation with social (calling the child’s own name), language (short, monotone phrases), and non-social (alerting or orienting sounds) stimuli (Figure 1)Â in 61 ASD and 57 TD sleeping participants.Â The number of voxels with significant BOLD response ($p < 0.01$) to each condition was measured within each participant’s left and right STS as determined by hand tracing on the anatomical MR image. The proportion of activated voxels within these two regions between groups and conditions was compared using a general linear model.
Results: Â By design, groups were well-matched on age and gender. In the left STS, response was related to condition across all participants ($F(1,116) = 5.3$, $p = 0.02$), individuals with ASD showed reduced responsiveness across conditions ($F(1,116) = 6.3$, $p = 0.01$), and there was a significantly different pattern of response across conditions in the two groups ($F(1,116)$: 5.9, $p=0.02$). The interaction is illustrated in Figure 2: Whereas the TD group showed a stair-step reduction in response from social to language to non-social stimuli, the ASD response was not differential across conditions. For the right STS, there was no linear effect of condition on brain response ($F(1,116) = 1.96$, $p = 0.17$), but across conditions the ASD group had less response ($F(1,116) = 7.7$, $p= 0.006$). The pattern of response to the conditions was not significantly different between groups ($F(1,116) = 3.0$, $p = 0.08$).
Conclusions: Infants and toddlers who go on to be diagnosed with an ASD show reduced responsiveness in the left and right STS to auditory stimuli during natural sleep. Furthermore, in the left STS, the typical preferential responsiveness to social compared to language and non-social stimuli is not present among ASD infants and toddlers. Failure to demonstrate a graded response of the left STS to socially-meaningful stimuli may be an early neural marker of ASD that portends future behavioral deficits.

Oral Session - 15A
191 - Gene Discovery in ASD
1:15 PM - 2:05 PM - Yerba Buena 10-14

Session Moderator: Alan Packer, *Simons Foundation, New York, NY*

1:15 **191.001** Genome Sequencing of 2,064 Genomes from 516 Simplex Families with Autism

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Background: The Simons Simplex Collection contains ~2,500 simplex autism families and has been previously studied through microarray and whole exome sequencing approaches. These studies have identified *de novo* and inherited risk factors that contribute to ~20-30% of autism and primarily affect the coding sequence of the genome. The remaining genetic risk factors for autism are currently unknown.
Objectives: To understand the genetic etiology for cases not due to *de novo* gene disruptive events, our hypothesis is that these individuals with autism have variants within the exome and previously missed by other approaches and / or are enriched for variants in noncoding, regulatory DNA.
Methods: We performed deep (30-fold) Illumina whole-genome sequencing (WGS) on 2,064 genomes from 516 simplex autism families negative for *de novo* likely gene-disruptive (LGD) mutation or large (>100 kbp) copy number variants (CNV). Using a hybrid cloud / local compute analysis workflow we processed all genomes in one month. We applied two SNV/indel and four CNV callers to generate a sensitive variant call set of 59 million SNVs/indels and 193 thousand unique CNVs. Extensive, orthogonal experimental validation was undertaken to determine the inheritance status of high-impact variants.
Results: WGS analysis recovered ~25% more *de novo*, exonic SNV/indels and ~85% more gene-disrupting CNVs than previously discovered by whole-exome sequencing (WES) analysis of the same samples. This included *de novo* LGD events in *GLIPR1L2*, *PHIP*, *PCM1*, *MED12L*, and *VARS* and gene-breaking *de novo* CNVs in *CHD2, DDX43, DMD, FANCA, LINC01347, LNPEP*, *MIR3129*, *MUC19*, *PCDHB17*, *PCDHB6*, *TAF1B*, and *ZNF462*. We observed a significant enrichment (p=0.01) of *de novo* missense mutations in children with autism when compared to their unaffected siblings for autism risk genes with known dosage sensitivity. This included proband-specific events in *UBE3C*, *PTEN*, *SUV420H1*, *CREBBP*, *LAMC3*, *GABRB3*, *SYNGAP1*, *NR3C2*, *SRCAP*, *TRIP12*, *UNC45B*, *SCN2A*, *POGZ*, and *TRIO*. We also identified an enrichment of *de novo* SNVs/indels in 5' and 3' UTR events (p=0.02) and in transcription factor binding sites (p=0.03). We report a modest enrichment (p=0.04) of *de novo* and private disruptive mutations for putative regulatory elements for dosage-sensitive autism genes. We define these as fetal central nervous system (CNS) DNase I hypersensitive sites mapping within 50 kbp of the start and end of the candidate gene transcript. Functional testing of the regions affected by these events confirms that the CNVs enrich in enhancers within the central nervous system.
Conclusions: Overall, WGS provides additional insight into the genetic etiology of autism by significantly increasing the yield of gene-disrupting mutations and by providing access to noncoding portions of the genome which when deleted adversely affect dosage of autism-risk genes during development.

1:27 **191.002** Integrative Analyses of Autism and Intellectual Disability Exome Data Reveal Similarities and Divergences and Identify Novel Risk Genes for Both Disorders

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Background:
Autism spectrum disorder (ASD) and intellectual disability (ID) are known to have a complex genetic architecture. ASD and ID frequently co-occur and recent analyses suggest that the genetic architecture might differ in individuals with low or high cognitive function. These findings raise questions about shared risk and compel analyses that intersect the genetic studies in ASD and ID since they have so far proceeded along parallel routes.
Objectives:
The objective was to understand the nature of shared genetic risk between ASD and ID.
Methods:
We assimilated rare variants identified via exome sequencing of 4,216 ASD and 1,479 ID trios, as well as 869 ASD cases and 2,829 control samples. We assessed the evidence for association using TADA, a statistical algorithm that combines information across different classes of evidence and produces a set of dominant-effect risk genes with varying levels of significance, measured as q-values. Genes were categorized based on level of evidence as strong ($q < 0.05$), moderate ($0.05 < q < 0.3$), weak ($0.3 < q < 0.6$) and negligible ($q > 0.6$).
Results:
For ASD and ID we find 31 and 64 genes with strong evidence (referred to as tASD and tID), 92 and 99 genes with moderate evidence, and 355 and 320 genes with weak evidence of association, respectively. A cross-classification of genes by FDR level shows substantial overlap in these risk gene lists (Chi-square $p < 10^{-15}$): 12 genes show strong evidence ($p < 10^{-20}$) (referred to as tASD.ID genes) of conferring risk for both disorders. Based on the pattern of de novo LoF, we estimated the total number of autosomal dominant genes in which de novo LoF imparts substantial risk for ASD (K_{ASD}) and ID (K_{ID}), respectively. We estimated a 95% confidence interval for K_{ASD} of 500-950 and K_{ID} of 185-225. Impact on nonverbal IQ (NVIQ) in probands diagnosed with ASD differs across categories: a de novo loss-of-function (LoF) mutation in a tID or tASD.ID gene had an average drop on NVIQ of about 24 points, while a de novo LoF mutation in a tASD gene had a weaker effect (~12 points reduction). The substantial genetic overlap in signal for ID and ASD motivates pooling the data to enhance power and thus gene discovery. Using this strategy, we identified 16 additional risk genes with $q < 0.05$, many of which cross-validated in complementary datasets.
Conclusions:
Despite having a much larger sample of ASD probands, we identify twice as many ID-related genes. This is consistent with a model in which de novo mutations contribute risk in a higher proportion of ID subjects than ASD and/or each mutation contributes a greater degree of risk in ID than ASD. We identified 12 genes that confer risk to both disorders and observed a dearth of genes that show strong evidence for association with ID but no evidence of association with ASD and vice versa. Finally, mutations in ID genes can have a marked impact on IQ of ASD subjects, whereas mutations in ASD-only genes have smaller impact.

1:39 **191.003** Interaction Between Human Sexual Dimorphism and ASD Neurobiology.

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Background: The 4:1 male to female sex bias is one of the most consistent and striking observations in autism spectrum disorder (ASD). One explanation for this sex bias is the existence of a female protective effect (FPE), in which a greater burden of ASD risk factors are required for a diagnosis of ASD in females than in males. Direct observation of de novo ASD risk factors in genomic analysis supports this hypothesis, however indirect assessment of sibling ASD recurrence risk in epidemiological studies finds little supporting evidence for the FPE. Understanding the nature and mechanism of this protection may hold great potential for therapeutic strategies.
Objectives: To assess the role and potential mechanism of female protection in ASD
Methods: To explain the discordant genomic and epidemiological evidence for the FPE we developed a simulation of ASD risk in families to estimate the power to detect a difference in the burden of de novo mutations vs. sibling recurrence risk. Should the FPE exist, it must act through sexually dimorphic processes, including gene expression. We therefore also compared gene expression data from male and female brain samples in the BrainSpan dataset ranging from mid-fetal to adult developmental stages to identify such sex differences in neurobiology.
Results: Under a quantitative model of ASD risk (Gaugler et al.2014), in which 50% of ASD risk in the population comes from unique environmental exposure, 47% comes from common inherited genetic variants and 3% comes from rare de novo mutations, we estimated the power to detect the FPE. Considering de novo mutations we achieve 80% power with a sample of about 500 ASD families, consistent with genomic literature. Furthermore, by combining exome and CNV data for over 5,500 ASD cases we consistently observe an increased burden of ASD risk factors in females, to a similar extent as predicted by the simulation. In contrast, the power to detect a significant difference in sibling recurrence rate in 10,000 ASD families remains below 30%. The FPE hypothesis is therefore also consistent with the epidemiologic literature. To explore the nature of the FPE, we assessed differential gene expression using RNA-Seq from over 1,200 region- and age-specific samples from males and females. We find similar developmental trajectories of gene expression in both sexes, with the exception of genes specific to microglia that are enriched in males during mid-late fetal development. These genes overlap with those observed in co-expression modules previously observed to be upregulated in ASD brains.
Conclusions: The FPE is the leading hypothesis of the underlying mechanism of ASD sex bias, with strong supporting evidence from genomic studies. The existing large-scale epidemiological analyses remain under-powered to corroborate this finding. Analysis of human transcriptome data identifies higher expression of microglial genes during male fetal development and finds that these genes overlap with those over-expressed in the post mortem ASD brain. This cellular and molecular pathway may sensitize males to ASD risk factors, and may account for the apparent female protective effect in ASD.

1:51 **191.004** Role of De Novo Intronic Indels in Autism

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Background: Over the past several years, analysis of whole-exome sequencing and microarray hybridization data from collections of families of children with autism like the Simons Simplex Collection (SSC) has increased our understanding of the genetic architecture of autism.Â Contributions from de novo (DN) mutation, rare and common variants have been established, but most progress has been made in the study of DN variants. DN germ line likely gene-disrupting (LGD), missense and copy number variants have been estimated to jointly contribute to approximately 30 percent of the autism in simplex families (Iossifov et al., 2014). The observed DN mutations in the ~5,000 affected children enabled the identification of lists of few hundred genes that with high confidence are involved in autism's etiology (autism genes). For example, half of the 546 genes targeted by published DN LGD mutations (LGD targets) are expected to be true autism genes.
Objectives: Â Whole-genome sequencing data sets were recently generated from the SSC, and we sought to determine if the additional types of DN variants that can be detected from whole-genome sequencing data, including noncoding variants and complex structural rearrangements, also contribute to autism. In this study, we specifically explored the contribution of DN noncoding mutation by focusing on the introns of the autism genes identified by the exome sequencing.
Methods: We analyzed whole genome data generated from the father, mother, a child with autism and an unaffected child of 510 families from the SSC chosen to have no DN LGDs or CNVs in the exomes of the affected children. The 150bp paired-end dataset was generated at the New York Genome Center with average depth of 30x. About 20,000 de novo intronic substitutions (DIS) and 2,000 de novo intronic indels (DII) were identified, using our multinomial genotyper with stringent cutoffs. We determined that the rate of false positives in this set is <5% and the rates of such de novo events was in agreement with published rates.
Results: There was no significant difference between the numbers of all DIS and all DII between the affected and unaffected children. But in the introns of the 546 LGD target genes, we identified 63 DII in the 510 affected while we found only 37 in the 510 unaffected children. The difference of 26 events is significantly larger than 0, (p-values of 0.01). The significance increases if we restrict to the half of the LGD targets that are more intolerant to damaging variants in human population and are expected to be even more enriched for autism genes (p-value of 0.005) while the delta barely shrinks (from 26 to 23). There was no significant difference in the number of DISs in any of these sets and there was no significant difference of the numbers of DIIs or DISs in gene targets of DN missense or DN synonymous.
Conclusions: From the observed increase in DIIs rates in children with autism, we estimated that DN intronic variants might contribute ~20% of the autistic children in simplex families.

Oral Session - 15B
192 - Epigenetics and Transcriptomics
2:10 PM - 3:00 PM - Yerba Buena 10-14

Session Moderator: Alan Packer, *Simons Foundation, New York, NY*

2:10 **192.001** Transcriptional Gene Silencing of the Autism-Associated Long Noncoding RNA MSNP1AS in Human Neural Progenitor Cells

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Background: The long noncoding RNA (lncRNA) *MSNP1AS* (moesin pseudogene 1, antisense) is a functional element that was previously associated to autism spectrum disorder (ASD) with genome wide significance. Expression of *MSNP1AS* was increased 12-fold in the cerebral cortex of individuals with ASD and 22-fold in individuals with a genome-wide significantly associated ASD genetic marker on chromosome 5p14.1. Overexpression of *MSNP1AS* in human neuronal cells caused decreased expression of moesin protein, which is involved in neuronal process stability.
Objectives: In this study, we hypothesize that *MSNP1AS* knockdown impacts global transcriptome levels.
Methods: We transfected the human neural progenitor cell line, SK-N-SH, with constructs that caused a 50% suppression of *MSNP1AS* expression. After 24 hours, cells were harvested for total RNA isolation. Strand-specific RNA-Seq analysis revealed changes in gene expression.
Results: RNA-Seq analysis indicated altered expression of 1,352 genes, including altered expression of 318 genes following correction for multiple comparisons. Expression of the *OAS2* gene was increased >150-fold, a result that was validated by quantitative PCR. Gene ontology analysis of the 318 genes with altered expression following correction for multiple comparisons indicated that upregulated genes were significantly enriched for genes involved in immune response and downregulated genes were significantly enriched for genes involved in chromatin remodeling.
Conclusions: These data indicate multiple transcriptional and translational functions of *MSNP1AS* that impact ASD-relevant biological processes. Chromatin remodeling and immune response are biological process implicated by genes with rare mutations associated with ASD. Our data indicate that the functional elements implicated by association of common genetic variants impact the same biological processes, suggesting a shared common molecular pathway of ASD.

2:22 **192.002** RNA-Seq Analyses of RORA-Deficient Neuronal Cells and Brain Tissues from Individuals with ASD Provide Support for RORA As a “Master Regulator” of Genes Impacted By Autism

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Background: Â We have previously shown that multiple cohorts of individuals with autism exhibit reduced expression of *RORA*both in the brain as well as in lymphoblastoid cell lines derived from individuals with ASD. We further showed by RORA-dependent chromatin immunoprecipitation followed by microarray (ChIP-on-chip) analyses that RORA, a nuclear hormone receptor, can potentially regulate the transcription of over 2500 genes, including more than 400 genes associated with ASD through genetics and functional analyses. The latter study suggested that RORA may serve as a “master regulator” of genes involved in the pathogenesis of autism.
Objectives: Â This study was conducted to investigate the genome-wide impact of targeted knockdown of *RORA* expression in a neuronal cell model as well as the transcriptomic profile of postmortem brain tissues from individuals with ASD that were previously determined to be *RORA*-deficient by RT-qPCR analyses. Moreover, we were interested in validating altered expression of predicted transcriptional targets of RORA in the RORA-deficient cells and tissues.
Methods: Stable knockdown of *RORA* expression was induced by transfection of SH-SY5Y neuroblastoma cells (an experimental model for neuronal cells) with shRORA RNA, followed by selection of stable transfectants by maintaining the cultures in puromycin. Knockdown of *RORA* expression in the transfected SH-SY5Y cells relative to that in cells transfected with a negative control shRNA was verified by RT-qPCR analyses. The stable *RORA* knockdown and control cells as well as brain tissues from the frontal cortex (BA 9/10 region) of age-matched male cases and controls were submitted for RNA sequencing (RNA-seq) to investigate the transcriptional profiles associated with *RORA*deficiency. Functional analyses of the differentially expressed genes were performed using Ingenuity Pathway Analysis software.
Results: Stable knockdown of *RORA* expression in the SH-SY5Y cells resulted in altered expression of approximately 4500 genes with a fold-change ≥ 1.4. Among the differentially expressed genes, approximately 500 had been previously identified as putative targets of RORA by our ChIP-on-chip analysis. RNA-seq analysis of *RORA*-deficient postmortem brain tissues from autistic individuals in comparison to those from controls revealed 156 differentially expressed genes, with 45 of these genes overlapping those affected by stable *RORA*knockdown in the cell model. Network prediction and pathway analyses of the differentially expressed genes revealed significant over-representation of genes associated with neurological functions (e.g., neuronal migration and neuritogenesis) and canonical pathways (e.g., ephrin receptor and axonal guidance signaling) impacted by ASD.
Conclusions: Â Collectively, the RNA-seq analyses of *RORA*-deficient neuronal cells and brain tissues validate a large number of transcriptional targets of RORA identified by our prior ChIP-on-chip analyses. Moreover, these results support our earlier findings and hypothesis that *RORA* is an autism risk gene whose deficiency in a subgroup of individuals with ASD can lead to much of the molecular pathophysiology currently associated with ASD.

2:34 **192.003** ASD-Associated Genomic Variants in 16p11.2 and CHD8 Exhibit Clinically and Biologically Functional DNA Methylation Signatures

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Background: One of the greatest challenges in studying autism spectrum disorder (ASD) is the degree of etiologic heterogeneity. Over 200 ASD-risk genes have been identified, but each gene accounts for <1% of all ASD cases and genetic causes have been identified in only ~25% of cases. A role for epigenetic dysregulation in ASD etiology is supported by the many ASD-risk genes that function as epigenetic regulators. We and others have proposed that aberrant epigenetic mechanisms resulting from genetic and/or environmental influences may alter biological pathways important for normal brain development. Previous studies have identified alterations in DNA methylation (DNAm), the most commonly assessed epigenetic mark, in ASD patients. However, the impact of these findings is limited by small sample sizes and inconsistent results across studies.
Objectives: 1) To investigate the role of epigenetic dysregulation in ASD. 2) Improve the discovery of DNAm differences by examining more homogeneous groups of individuals substratified based on known ASD-associated genomic variants.
Methods: Â Genome-wide DNAm was measured using the Illumina Infinium HumanMethylation450 BeadChip array in DNA extracted from whole blood for all groups. First, we compared DNAm in a heterogeneous ASD group (n=52) with age- and sex-matched neurotypical controls (n=30). Second, DNAm was also assessed from patients with genomic variants conferring an increased risk for ASD: 16p11.2 deletions at the 600kb risk locus (16p11.2del; n=9) or heterozygous loss-of-function mutations in a chromatin modifier, chromodomain helicase DNA binding protein 8 (*CHD8*$^{+/-}$; n=7). These groups were compared with age- and sex-matched controls (n=23 and n=21, respectively). We used a modified version of our laboratory's bioinformatics pipeline employing hierarchical clustering, principal components analysis and non-parametric statistical comparisons to identify significantly differentially methylated CpG sites.
Results: Â Although no significantly differentially methylated sites were identified to fully distinguish heterogeneous ASD cases from controls, unique DNAm patterns were identified for the 16p11.2del and *CHD8*$^{+/-}$ groups when compared with controls. These DNAm patterns consist of specific sets of differentially methylated sites (adjusted p<0.05, absolute difference ≥5%) comprising novel DNAm signatures. These signatures separated 16p11.2del and *CHD8*$^{+/-}$ individuals from both heterogeneous ASD and control groups with high sensitivity and specificity. They also accurately classified 16p11.2 CNV and *CHD8* sequence variants of unknown significance, distinguishing between pathogenic and benign mutations. Examining the genes in each signature revealed biological pathways that could be important to the pathophysiology of ASD, overlapping with known ASD-risk genes. Furthermore, some of the genes identified in our *CHD8*$^{+/-}$ blood DNAm signature overlapped differentially expressed genes in *CHD8*$^{+/-}$ (CRISPR/Cas9) human induced pluripotent stem cell-derived neuronal precursor and neuronal cells, demonstrating the cross-tissue functional significance of our *CHD8*$^{+/-}$ epigenetic signature.
Conclusions: Our approach constitutes a novel and clinically applicable method of molecular classification for ASD, identifying DNAm biomarkers in an easily accessible tissue. These findings elucidate the etiology of subgroups of ASD in the context of the crucial cross-talk between genetics and epigenetics. Combined, these data will enhance our understanding of the underlying biological mechanisms of ASD and facilitate the identification of novel therapeutic targets to facilitate precision medicine-based treatment options.

2:46 **192.004** Whole-Genome Bisulfite Sequencing Reveals Autism-Associated Hypomethylation and Differentially-Methylated Regions in Umbilical Cord Blood Samples from the Prospective Marbles Study

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Background: Autism spectrum disorders (ASD) have complex etiologies, likely involving multiple genetic and environmental insults in perinatal life. Genetic susceptibility can interact with environmental risk factors such as pesticides, air pollution, and persistent organic pollutants. The perinatal period is critical for both nutritional protective factors, such as the methyl donor folate, and interactions with genetic regulators of one-carbon metabolism. The epigenetic layer of DNA methylation, at the interface of genetic and environmental risk and protective factors, holds promise for improved understanding of complex ASD etiologies.
Objectives: Currently, ASD is diagnosed behaviorally at two years of age; however, existing interventions are most effective the earlier they are begun. Biomarkers for ASD at birth are largely unknown and would facilitate earlier diagnosis and more effective treatment. We performed this study to identify DNA methylation biomarkers predictive of ASD diagnosis by age three.
Methods: The MARBLES (Markers of Autism Risk in Babies - Learning Early Signs) prospective study is an enriched risk cohort that enrolls couples who have already had a child with ASD and follows their subsequent pregnancy. We investigated human umbilical cord blood samples from the MARBLES study by whole-genome bisulfite sequencing (WGBS) and expression microarray (*n*= 26 TD, 26 ASD).
Results: ASD cord blood samples showed significantly lower global percent CpG methylation compared to typically-developing (TD) controls (ASD 76.6% vs TD 77.4%, p = 0.01). ASD-associated hypomethylation was observed across most chromosomes and gene bodies. 20 kb windowing of the genome demonstrated a global shift of hypomethylation, with 81% of windows hypomethylated in ASD samples. Smaller differentially-methylated regions (DMRs) enriched for CpG islands were also identified in ASD cord blood (5,828 total DMRs). 60% of all DMRs were hypomethylated, but all DMRs that were significant after correction for multiple hypothesis testing were hypermethylated. DMRs in ASD cord blood were nearby genes significantly enriched for functions in organic cyclic compound binding (2797 DMRs, Bonferroni-adjusted $p = 2.4\text{x}10^{-11}$) and abnormal blood cell morphology and development knockout mouse phenotypes (1277 DMRs, Bonferroni-adjusted $p = 1.1\text{x}10^{-11}$), highlighting the potential influence of the environment and immune system in ASD. Hypomethylated DMRs were also significantly enriched near SFARI ASD candidate risk genes (253 genes, Bonferroni-adjusted $p = 7.6\text{x}10^{-4}$). Methylation at four of the DMRs with genome-wide significance showed a significant positive association with Autism Diagnostic Observation Schedule (ADOS) severity scores. Methylation at two significant DMRs showed a significant negative association with mRNA levels of nearby genes.
Conclusions: Global hypomethylation in ASD cord blood suggests a methylation deficiency in ASD during perinatal life, which could be a cumulative effect of genetic variants, environmental exposures, and/or shortage in methyl donors. Identified DMRs are relevant to ASD and have potential as a diagnostic tool. In future studies, methylation will be examined in relation to demographic, genetic, environmental, and nutritional information collected in the MARBLES study. These results are expected to improve understanding of perinatal factors in ASD etiology and aid in future preventative and therapeutic treatments.